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ALLEN (H. W.). **Relation between Parasitization of Twig-infesting Larvae of the Oriental Fruit Moth and subsequent Infestation of ripe Peaches.**—*J. agric. Res.* **67** no. 3 pp. 81–88, 5 refs. Washington, D.C., 1943.

The following is based on the author's summary. During 1937, 1938 and 1939, 51 orchards in 11 peach-growing districts in Virginia, West Virginia, Maryland and New Jersey were surveyed to determine whether there was a correlation between parasitism of twig-infesting larvae of *Cydia* (*Grapholitha*) *molesta*, Busck, and subsequent infestation of the fruit [*cf. R.A.E.*, A **29** 130, etc.]. Several species of parasites were involved, but the most important was usually *Macrocentrus ancylivorus*, Rohw. Comparisons were made by arranging orchards in five classes according to the rate of parasitism, by considering individual orchards, by considering individual orchards over successive years, and by grouping orchards by year within a given area.

It was found that when the comparisons were limited to one season and a restricted district in which the conditions affecting the abundance of the moth, other than the parasitism measured, were reasonably uniform, high parasitism of twig-infesting larvae of the second generation was followed by correspondingly low fruit infestation, with evidence that this relation was significant. This condition existed each year and throughout the area surveyed, but was more evident in 1938 and 1939 than in 1937, and in the orchards in Virginia, West Virginia and Maryland than in those in New Jersey. When the observations were compared in any other manner, factors other than the observed parasitism, and apparently associated with the year and the locality, were sufficiently important to obscure the effect of parasitism of the second generation in reducing fruit infestation.

BEARD (R. L.). **The Significance of Growth Stages of Sweet Corn as related to Infestation by the European Corn Borer.**—*Bull. Conn. agric. Exp. Sta.* no. 471 pp. 173–199, 5 figs., 12 refs. New Haven, Conn., 1943.

The following is substantially the author's summary. In order to study the pattern of infestation by *Pyrausta nubilalis*, Hb., relative to growth stages of sweet maize, 14 plantings of Marcross and Lexington hybrids were observed for borer oviposition and survival. The initial planting was most severely attacked, and successive plantings attacked by the first generation were less severely infested; subsequent plantings became increasingly infested by the second generation until the ninth, after which the infestation declined.

Except for those too small to favour oviposition [*cf. R.A.E.*, A **31** 509], availability at the time of maximum oviposition determines which growth stages receive the most eggs. The tendency for oviposition to be delayed on some plantings until the plants reach a favourable size is responsible for shifts in the oviposition trend as related to time. The total number of second-generation eggs deposited greatly exceeded the number of first-generation eggs, though the first planting of the season received the greatest number of eggs per plant. Because the adults of the first generation were present for a much longer period than those of the overwintered generation, much more maize was available for attack by the second-generation larvae. Most of the first-generation eggs were deposited on maize in the early tassel stage or younger, whereas most of the second-generation eggs were deposited on maize in the early tassel and later stages. The pattern of infestation by the first generation relative to the stage of growth of the maize was not repeated in any planting attacked by the second generation.

The fate of eggs was considered only as an aid in estimating survival. The tendency for the borer population to parallel the intensity of oviposition was modified by differential survival rates, which seem to be governed principally by the growth stage of the plant at the time of borer establishment. At the

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same level of borer population, maize attacked by the second generation has fewer infested ears than that attacked by the first, but the ears that are infested contain more borers. The percentage of infested ears is related to the total borer population, whereas the percentage of borers in the ears is related to the growth stage of maize at the time of infestation.

In growth habit, Lexington differs from Marcross chiefly in a tendency to increased height and a delay in reaching the late whorl stage. Oviposition on the two hybrids did not differ significantly, but survival of the first generation was consistently lower in Lexington than in Marcross. Survival of the second generation did not differ significantly between the hybrids. The difference between the two generations in regard to survival is explained on the basis of differential growth rates at growth stages critical to borer establishment. It is suggested that the resistance of maize at different growth stages and the resistance of one strain of maize as compared with another are two expressions of the same fundamental phenomenon, and that a resistant strain may owe its resistance to a differential growth rate at a particular time relative to the pattern of infestation. If the pattern is different, the resistance may be lost.

TAYLOR (J. S.). **Notes on *Brachymeria* sp. (Chalcididae), a Pupal Parasite of *Cactoblastis cactorum* Berg.**—*Proc. R. ent. Soc. Lond.* (A) **18** pt. 7–9 pp. 58–63. London, 1943.

The host relationships of Chalcids of the genus *Brachymeria* are briefly reviewed, and it is stated that the only one hitherto recorded from South Africa is *B. polyctor*, Wlk., which parasitises *Acanthopsyche junodi*, Heyl., on wattle [*Acacia*]. In and after the summer of 1939 an unidentified species of the genus was observed attacking pupae of *Cactoblastis cactorum*, Berg, in the Karroo. Collections of cocoons of both summer and winter generations of the moth were made in one locality during 1939–42 and in two others for shorter periods, and it was found that the percentages parasitised fluctuated but showed a tendency to increase. The lowest recorded in any one place was 0·02 and the highest 36. No native hosts were found, and *A. junodi* does not appear to be present locally. In the laboratory, the females punctured cocoons of *Terastia meticulosalis*, Gn., but failed to oviposit in them, and negative results were also obtained with *Braura truncata*, Wlk., and *Papilio demodocus*, Esp.

Studies on the bionomics of the parasite were begun in October 1941, and it was successfully reared on cocoons of *C. cactorum* in jars, but not in small vials. The adults, which fed readily on moistened raisins, were very active in warm weather, and at suitable temperatures mated and oviposited immediately after emergence. The females sometimes oviposited several times in one host pupa, but both host and parasites in it then generally became desiccated; it was unusual for two parasites to emerge from the same host, and if they did, one was undersized. Cocoons are punctured at any time after their formation, but all of 132 pupae that were successfully parasitised were attacked 3–36 days after the cocoons were formed, and the greatest number of parasites emerged from cocoons punctured 11–12 days after their formation. Parasitism did not appear to occur unless pupation had been completed. Males and females of the summer generation lived for averages of 40·9 and 27·7 days, respectively, and those of the winter generation for 27·1 and 27. Unfertilised females gave rise to males only. The maximum number of cocoons attacked by one female was 24, but only 16 parasites emerged from them, and this was the greatest number of progeny produced by one female. The sex-ratio varied, but males preponderated slightly. The egg and larval stages together lasted 14 days in summer. In October–December 1941, males completed their development in 30–45 days and females in 23–41, and in the following summer only 19–35 and 20–38 days, respectively, were required; in March–July 1942, the development of males lasted as long as 80 days.

The percentage parasitism in cocoons that were fully exposed or situated between the joints of prickly-pear [*Opuntia*] or in decayed stumps was higher than that in cocoons buried under débris or in loose soil. When unparasitised laboratory-reared cocoons were buried under a half-inch layer of loose soil in the open during winter, many were exposed or removed by ants, and at least 4·5 per cent. were parasitised by *Brachymeria*. When the experiment was repeated in the summer, the cocoons being situated in permanent shade and protected from ants, no parasitism occurred.

Howe (R. W.). **Life History Data for *Ptinus tectus* Boie. (Coleoptera, Ptinidae) at 70% Relative Humidity at 21°C. and 25°C.**—*Proc. R. ent. Soc. Lond.* (A) **18** pt. 7–9 pp. 63–65, 2 refs. London, 1943.

Observations were made on the duration of development of *Ptinus tectus*, Boield., when reared on fish-meal at temperatures of 21 and 25°C. [69·8 and 77°F.] and a relative humidity of 70 per cent. Eggs were laid in an oviposition tin standing on a petri dish containing fish-meal, and 98 per cent. hatched at each temperature. The larvae were isolated in small glass tubes containing a little fish-meal. The average durations of the egg stage, the first, second and last larval instars and the pupal stage were 8, 9·2, 11·4, 23·2 and 9·9 days, respectively, at 25°C., and 8·6, 12·1, 16·2, 30·7 and 15·9 days at 21°. Occasionally an additional instar occurred before the final one, and this averaged 9·5 days at 25°C. and 16·4 at 21°C. These periods are compared with those recorded by other workers [*R.A.E.*, A **30** 161; **31** 231], and it is concluded that the optimum temperature for speed of development is about 22·5°C. [72·5°F.].

Bennett (S. H.) & Kearns (H. G. H.). **A Method of Washing out Wireworms from Soil Samples.**—*Rep. agric. hort. Res. Sta. Bristol 1942* pp. 49–50, 1 pl., 1 ref. Bristol [1943].

A method of removing wireworms from soil samples is described that provides a rapid means of examining large numbers of 4-in. core samples for larvae 5 mm. and more in length. A nest of four sieves, 14–16 inches in diameter, with a 3-inch space between each and having mesh apertures of 3, 1·1, 0·82 and 0·6 mm., respectively, is placed on a low frame covered with wire netting and the soil is washed through the sieves by means of a hand-operated short spray gun fitted with a 1/16th-inch disk and supplying water at a pressure of 150–200 lb. per square inch and an approximate rate of 3 gals. per minute. Each sample requires from 1 to 3 gals. The samples are soaked for 12–24 hours before being treated, and turf layers, which require hand manipulation to ensure that all the wireworms are exposed to the jet, are treated separately. The wireworms are retained in the two finest sieves, and these are then placed in a 20 per cent. salt solution to float them from the débris. The finest sieve may sometimes become clogged unless the jet is applied directly to it, especially where clay soils are being sampled. Using this method, two operators and one observer prepared and examined an average of 200 4-in. core samples in six hours; another advantage is the elimination of manipulation of the wet soil, which renders clay intractable.

Parkin (E. A.). **The Moisture Content of Timber in Relation to Attack by *Lyctus* Powder-post Beetles.**—*Ann. appl. Biol.* **30** no. 2 pp. 136–142, 3 graphs, 9 refs. London, 1943.

The following is substantially the author's summary. The relation between the moisture content of oak sapwood and the rate of development of *Lyctus brunneus*, Steph., was investigated at 23°C. [73·4°F.]. Oviposition took place normally in samples of various moisture contents between 5·5 and 23·5 per

cent. The eggs hatched when the moisture content was 7·7 per cent., but not when it was 6·1 per cent., although the embryos developed fully. The rate of gain in weight of young larvae increased to a maximum as the moisture content of the wood rose to about 14·2 per cent. and then fell. The rate of development from egg to adult followed a somewhat similar curve, with a maximum at 16 per cent. moisture content. At all moisture contents, the first male emerged a few days earlier than the first female. The average weight of the male beetles was less and their moisture content greater than those of the corresponding females. The average weight of the beetles showed a tendency to increase at moisture contents of the wood above 9·7 per cent. The average moisture content of the males was fairly constant up to 15·6 per cent. moisture content of the wood, but that of the females rose slowly as the moisture content of the samples increased. In wood of 15·6 per cent. moisture content at 23°C., the minimum period of development from egg to adult was 167 days ; at 14·2 per cent. and 27·5°C. [81·05°F.], it was 142 days. Green timber was shown to be liable to infestation as soon as a superficial outer layer of suitable moisture content was formed ; the upper limiting moisture content is probably the fibre saturation point. Control of the moisture content of timber cannot be achieved sufficiently easily for it to become an important method for the control of *Lyctus* infestation.

BUTLER (C. G.), FINNEY (D. J.) & SCHIELE (P.). **Experiments on the Poisoning of Honeybees by insecticidal and fungicidal Sprays used in Orchards.**—*Ann. appl. Biol.* **30** no. 2 pp. 143–150, 2 figs., 8 refs. London, 1943.

The following is substantially the authors' summary. Losses of honey bees by poisoning have greatly increased in recent years following the growing use of insecticidal and fungicidal sprays on fruit-trees. Preliminary laboratory tests showed that of the common constituents of spray mixtures, only lead arsenate and flowers of sulphur were likely to cause serious poisoning, though a proprietary derris spray appeared to have slight toxic effects. Syrup containing lime-sulphur, nicotine sulphate or copper sulphate was strongly repellent, and it therefore seemed possible that spray mixtures might be made repellent to bees by adding suitable substances. Laboratory trials showed that lead arsenate sprays at the concentrations normally used were no more attractive to bees than distilled water. Lime-sulphur and nicotine sulphate at concentrations of 1 : 500 and 1 : 2,000, respectively, reduced the amount of *M*/1 sucrose solution imbibed by the bees to less than 10 per cent. of that of unadulterated sucrose solution, and very much lower concentrations appreciably affected the amount taken. The presence of lead arsenate in these solutions seemed to increase their repellent effect. When orchard conditions were simulated by evaporating the solutions to dryness and taking them up again in distilled water, the repellent effect was reduced, though not entirely destroyed. Creosote (0·13 per cent.), which has been suggested as a possible repellent, gave erratic results in laboratory tests, and in view of its phytocidal action, its use is not recommended.

Open flowers of apple trees were sprayed with various mixtures under orchard conditions, and counts of bees showed that lime-sulphur (1 per cent.) and nicotine sulphate (0·05 per cent. nicotine) retained their repellent properties for at least seven days, in spite of heavy rain. As bees can be deterred from visiting open flowers by these means, it should be possible to prevent them still more from collecting water contaminated by sprays applied at the normal time.

Data collected in Britain during the past three years show that calcium arsenate and lead arsenate are the constituents of orchard sprays that are responsible for poisoning honey bees. Arsenic may be collected when fruit trees or the plants beneath or near them are visited for pollen or water, and contaminated water appears to be the chief cause of poisoning ; a dose of about 0·00005 mg.

internal arsenic per bee was found to be lethal. It is concluded that when arsenical sprays are used alone, particularly if they are applied to open flowers, as sometimes occurs with cherries and gooseberries, severe poisoning from the pollen may be expected. Much of the danger from contaminated water would probably be removed by the incorporation of 1 per cent. or more lime-sulphur or enough nicotine sulphate to provide 0·05 per cent. nicotine in sprays for application before flowering or after petal-fall, provided that alternative sources of water are available for foraging bees. Provision of water within the hive is suggested as a further safeguard.

KEVAN (D. K. McE.). **The Neotropical Cornstalk Borer, *Diatraea lineolata*, Walk., and the Sugar-cane Moth Borer, *D. saccharalis* (Fabr.), as Maize Pests in Trinidad, with Notes from Grenada.**—*Trop. Agriculture* **20** no. 9 pp. 167–174, 2 pls., 27 refs. Trinidad, 1943.

In view of the recent finding that *Diatraea lineolata*, Wlk., and *D. saccharalis*, F., could be of importance as pests of maize in Trinidad [*R.A.E.*, A **31** 258], a survey was made in the western half of the island in 1942–43 and in Grenada in 1943. *D. lineolata* was not observed in Grenada, but two examples were obtained from Tobago. Normal larvae of these Pyralids cannot be distinguished from each other, though the resting larvae of *D. lineolata* are distinct [*cf.* **31** 259]. In Trinidad, *Diatraea* spp. were commoner in the north than in the south, but there was no seasonal variation in numbers, the extent of infestation being approximately the same on the main crop, which is planted in May–June, at the beginning of the rains, and harvested in October–November, and on the second crop, which is planted immediately after the first harvest and is reaped in January–February, at the beginning of the dry season. The damage was not serious either in Trinidad or in Grenada. A short account is given of the life-history of *D. lineolata*, which differs little from that of *D. saccharalis* except for the occurrence of the resting stage in which some of the larvae survive the dry season. The first resting larvae are found in the stems when the plants begin to mature, and they do not pupate until the rains begin in May. The nature of the damage caused to maize is described; the reduction of young cobs to a rotting mass is of little importance, since they are replaced by ears that would not otherwise develop, but tunnelling in the stalks weakens the plants so that they tend to be broken by wind or cultivation and may cause considerable reduction in yield owing to the destruction of vascular tissue and consequent loss of vigour of the plants.

The course of a typical attack by *Diatraea* spp. in Trinidad is shown graphically and in tables. The females appear to be attracted to the maize for oviposition chiefly just before tasselling and scarcely at all by the time the cobs are formed. The mortality of young larvae is probably considerably more than the observed 56 per cent. Damage by *D. saccharalis* is relatively unimportant, occurring chiefly in the young plants, and after the first five weeks of infestation this species is mostly replaced by *D. lineolata*, which attacks the maize for a longer period and is much more injurious. Maize was more heavily infested by *D. saccharalis* when grown near sugar-cane, but not sufficiently so to make it necessary to discourage the planting of the two crops in proximity. Tests of various grasses as alternative food-plants of *D. lineolata* showed that teosinte (*Euchlaena mexicana*) was as attractive as maize, although the larvae did not seem to develop so well on it, but that the others were not attacked. *E. mexicana* is only grown experimentally in Trinidad.

Parasites of the larvae found in maize in Trinidad comprised a fungus resembling *Empusa*, an unidentified species of *Theresia*, *Microdus* (*Bassus*) *stigmaterus*, Cress., *Apanteles diatraeae*, Mues., and a single empty cocoon, probably of *Ipobracon grenadensis*, Ashm. *A. diatraeae* was the only parasite of *D. saccharalis* found in maize in Grenada, apart from an empty cocoon, also probably of

I. grenadensis. The data indicated that *Theresia*, *Apanteles* and the fungus commonly attack *D. saccharalis* very heavily in Trinidad, and that *D. lineolata* is parasitised by *Apanteles* and possibly also by *Microdus* and the fungus, though parasitism of this species is very slight. The total percentage parasitism of *Diatraea* in Trinidad ranged up to 15·5 in 1942 and up to 10 in 1943; *Theresia* and *Apanteles* appear to be equally important, and the other species negligible.

Possible control measures suggested comprise the destruction of all maize stalks during the dry season [*cf. loc. cit.*] and discouraging attempts to grow maize during the dry season under irrigation or in swamp areas, which would probably almost eliminate *D. lineolata* in Trinidad; the introduction of *Theresia* into Grenada for the control of *D. saccharalis*; application of insecticidal dusts or sprays, once about a week before tasselling and again up to a week afterwards, on small areas of any seed maize grown to improve the local strain; and the use of cultural practices aiming at producing plants with strong thick stems that are less likely to break.

Briscoe (H. V. A.). **Some new Properties of inorganic Dusts.**—*J. R. Soc. Arts* **91** no. 4650 pp. 593–607, 3 graphs, 7 refs. London, 1943.

It has long been known that inert dusts will under certain conditions kill weevils (*Calandra granaria*, L.) in stored wheat, but there is little precise information as to their mode of action. Experiments were therefore carried out to investigate the factors involved from the physico-chemical point of view. Healthy adult weevils were placed in a tube with wheat containing about 14 per cent. moisture, which was mixed thoroughly with one of the dusts to be tested and kept at a constant temperature of 23°C. [73·4°F.]. The rate at which the dusts were used was usually 1 per cent. by weight. In tests carried out by this method, the efficiency of a commercial form of pure precipitated silica (Neosyl) that is fairly effective as an insecticide was not affected by extraction with boiling water, freshly distilled alcohol and ether, or freshly distilled benzene, boiling with concentrated hydrochloric acid, followed by thorough washing with water, or coating with a very slight film of stearic acid, indicating that chemical properties were apparently not involved. This was confirmed in tests with cleaned and purified fine diamond dust, which proved more effective than any dust previously tested, and other hard, chemically inert substances, such as carborundum, which were nearly as effective.

The methods of preparing and examining experimental dusts are described. Tests with powders of carborundum and quartz of known particle size, prepared by sedimentation, showed that particles over 15μ in diameter are too large to act at all; that effectiveness increases progressively with reduction in particle size from 10μ to 1μ; and that there may be a maximum of effectiveness at about 1–2μ. The adhesion of the dust to the insects appears to be important, since effective ones gave them a uniform light coating; and the variation in efficiency of particles of different size is probably due largely to variation in adhesion, since above 15μ there is none, at about 5μ the particles stick well to wheat and weevils, and at about 1μ the particles stick to each other very readily. The covering power seems to be greatest at about 1μ, and a dust of this fineness coats wheat and weevils thickly when mixed with the grain. Particle size was eliminated as a variable in the comparison of materials by using an excess of dust containing all ranges of particle size, the weevils being placed in a small dish containing plenty of the dust under test, but no wheat. The presence of sufficient effective particles was thus ensured, and the presence of the remainder did not affect the results. Comparison of dusts by this method indicated that intrinsic hardness has an important relation to effectiveness. However, since a few comparatively soft materials were abnormally effective and some forms of hard substances were relatively ineffective, and since

effectiveness was not sharply limited at the degree of hardness of the insect cuticle, it is probably some property closely related to hardness rather than hardness itself that is involved.

On the basis of these results, many possible materials were examined, and it was found that coal-ash clinker, which is hard, cheap and available in large quantities from power stations, was the most promising. Wet-ground clinker was much more effective than the same material ground dry to the same degree of fineness, possibly because the direct rubbing of the particles against each other in dry grinding rounds the corners and polishes the faces, producing an amorphous layer. Further investigation of this point showed that the nature of the liquid used is immaterial ; that the difference in effectiveness between dusts prepared by the two methods varies with the material ground ; that a precipitated material of the same composition is as effective as the wet-ground mineral ; and that micronised powders, in which the fine powder produced by dry-grinding is removed from the mill by an air stream as fast as it is formed, have generally the same insecticidal power as the same powders wet-ground. Tests on the effect of modifying the surface of dusts showed that etching with 3 per cent. hydrofluoric acid eliminates the difference between wet- and dry-ground quartz ; that brief immersion in water has no effect on quartz dusts, but suspending ether-ground quartz in a dilute solution of sodium carbonate reduces its effectiveness, possibly by rounding the particles ; and that the action of water on felspar dust markedly increases the effectiveness of the dry-ground material and improves the wet-ground dust, possibly because this action, which is known to be rapid and to result in a preferential extraction of alkali, may leave a superficial layer of hydrated silica, which would become converted into crystalline quartz when the dust was dried at 200°C. A relatively ineffective glass dust becomes as effective as quartz after a brief etching with 3 per cent. aqueous hydrofluoric acid, is slightly improved by heating to about 300°C., but becomes harmless if heated to the softening point, so that the particles become spherical. It seems likely, therefore, that the insecticidal effect of a dust is enhanced if the surface of the particles is angular in character.

Dissection of weevils showed that the dusts did not penetrate the respiratory system, but a certain quantity always entered the digestive tract and apparently caused a cessation of feeding. No internal effect of the dusts could be measured, however, since when provided with macaroni containing carborundum the weevils refused to feed, and died at the same rate as when kept on clean glass beads, presumably owing to starvation. On the same materials dusted with carborundum, mortalities were still equal but much higher, presumably owing to the combined effects of starvation and the surface action of the dust.

Simultaneous measurements of mortality rates and loss of weight in unfed weevils and mealworms (*Tenebrio molitor*, L.) showed that the effectiveness of the dusts depended on their effect in increasing the rate of loss of weight. This increase was found to be due to loss of water and not of carbon dioxide ; humidity had a marked effect on the efficiency of the dusts and the tissues of insects killed by them were shrivelled and desiccated. The dusts do not absorb water from the insects, but increase the loss of water vapour to the surrounding air, and the rate of loss is always 2–3 times greater when the insects are coated with an effective dust under any given conditions of humidity. It is considered unlikely that dusts accumulate between the segments, exposing the intersegmental membranes and so allowing increased diffusion of water to the air, since in this case increase in particle size should increase the loss of water, and a layer not more than 1μ thick would not be effective, as it is with some materials. It is suggested that dusts increase the transmission of water through the hard cuticle of the insect, and the structure of this is discussed. When the passage of water through an artificial membrane simulating to some

degree the probable nature of the cuticle and consisting of a celluloid membrane covered with a layer of beeswax 2–4 molecules thick, was compared with that through a clean celluloid membrane and through waxed membranes to which a thin layer of dust had been added, transmission through celluloid covered with a waxy film was only about one-sixth of that through clean celluloid, and that through the dusted films nearly as great as through clean celluloid in some cases. It is therefore considered possible that the dusts act by affecting the permeability of a fatty film on the cuticle ; the possible nature of such action is discussed.

In the later stages of the investigations, it was found that mineral dusts are effective against many insects, including *C. oryzae*, L., *Tribolium confusum*, Duv., *T. castaneum*, Hbst., *Tenebrio molitor*, *Ephestia kuehniella*, Zell., *E. cautella*, Wlk., *E. elutella*, Hb., *Oryzaephilus surinamensis*, L., *Ptinus tectus*, Boield., and *Cimex lectularius*, L.

KITCHENER (J. A.), ALEXANDER (P.) & BRISCOE (H. V. A.). **A simple Method of protecting Cereals and other stored Foodstuffs against Insect Pests.**—*Chem. & Industr.* **62** no. 4 pp. 32–33. London, 1943 ; also in *Trop. Agriculture* **20** no. 10 pp. 198–199. Trinidad, 1943.

The authors refer to recent work in the United States and Australia on the use of inert dusts for the control of insect pests of stored grain [*R.A.E.*, A **30** 489 ; **31** 45, etc.] and briefly summarise the results of investigations in England [see preceding abstract] that showed that coal-ash clinker is effective for this purpose. This material is largely a complex silicate of iron and aluminium, and since the silica is firmly bound, it is less liable than other siliceous minerals to cause silicosis [*cf.* **31** 381] in those handling the treated grain. More recently, a much more effective dust has been discovered. It is a fine white powder produced by a chemical process, and is chemically inert, insoluble in water, non-poisonous, and free from danger of silicosis. It is stated that this dust is about ten times as effective against *Calandra granaria*, L., as the best mineral dusts known, since it gave 40–50 per cent. mortality in a week when added to wheat in the laboratory at the rate of 0·1 per cent. ; that a small amount can be distributed very easily in a large bulk of grain ; that complete mixing with the grain is not essential, since infinitesimal amounts of the dust kill the weevils and it is only necessary for the insects to come into contact with it once, the almost invisible film that adheres to them having substantially the same effect as constant contact with excess dust ; and that grain dusted with the new product is scarcely distinguishable in appearance from untreated grain. A list is given of other species of stored-product pests that have been killed by this dust, from which it is concluded that it would probably protect most stored food products effectively against any of the common insect pests.

VRYDAGH (J. M.). **Les insectes nuisibles aux produits en magasin et les moyens de les combattre.**—*Not. phytopath. Inst. nat. Etude agron. Congo belge* no. 3, 12 pp., 3 pls., 10 refs. [Yangambi] 1941. [Recd. 1944.]

This is a list of 21 cosmopolitan Coleoptera and Lepidoptera that may be found damaging stored products in the Belgian Congo. Notes are given on their appearance and the products attacked, and a brief section is appended on common methods of control, largely by means of fumigants.

CHAKRAVORTI (S.). **Vacuum Fumigation—a new Technique of preserving Records.**—*Sci. & Cult.* **9** no. 2 pp. 77–81, 1 fig., 7 refs. Calcutta, 1943.

This is a general discussion of the methods and technique of fumigation in vaults and vacuum chambers against insect pests of stored commodities, with

special reference to pests of books and papers. Hydrocyanic acid gas, carbon bisulphide, a mixture of ethylene chloride and carbon tetrachloride (3 : 1 by weight), ethylene oxide, a mixture of methyl formate and carbon dioxide and one of ethylene oxide and carbon dioxide (1 : 9) are all effective and have no deleterious effect on paper, ink and other record components, but the last is regarded as the most suitable in virtue of its non-inflammability. Vacuum fumigation has been adopted in many libraries throughout the world, but has not so far been employed in India.

Sevastopulo (D. G.). **Pests of Tea.**—*J. Bengal nat. Hist. Soc.* **18** no. 1 pp. 20–21. Darjeeling, 1943.

The author recently received larvae and cocoons of two Limacodids observed feeding on tea in large numbers on an estate near Darjeeling and briefly describes them. One of them spins its cocoons among the leaves of tea and was identified as *Altha melanopsis*, Strand, but the other does so on or just below the surface of the soil and no adults were reared, so that it could not be identified. This habit is unusual among Limacodids, but is common to *Setora nitens*, Wlk., which also feeds on tea, and *Phocoderma velutinum*, Koll., which was observed attacking tung [*Aleurites*] in the Dooars some years ago. Parasites emerged from cocoons of both species, and the larvae are also parasitised. In a brief review of other families of insects that feed on tea, the author states that he bred the Lymantriids, *Orgyia postica*, Wlk., *Euproctis* (*Porthesia*) *scintillans*, Wlk., and an unidentified species of *Leucoma* from tea at Pashoke in December 1936.

Chiao (C. Y.) & Peng (D. S.). **China Wax or Insect Wax Industry in Szechwan. II. Further Studies on Wax Insects.**—*J. W. China Border Res. Soc.* (B) **14** pp. 128–132, 1 ref. Chengtu, 1943.

Investigations were begun in the field and in a greenhouse at Chengtu in 1940 on the development of the wax insect [*Ericerus pela*, Chav.], for which the only food-plant available was *Ligustrum lucidum* [*cf. R.A.E.*, A **29** 153]. The eggs were obtained from Kwan Hsien, and material from this source is regarded locally as inferior, since much of it is parasitised and the ultimate yield of wax is lower than from material from Yunnan, where parasitism is apparently less. The Coccids developed well in the greenhouse, and the wax-laden branches were left through the winter for egg-production in the spring. The females remained quiescent through the winter and began to secrete honey-dew at the beginning of February, continuing until the end of March. Many of the females died at this stage, owing to parasitism by insects, the action of fungi that developed on the honey-dew and the dying of some of the branches. The size ultimately reached by the females varied considerably, and eggs were produced in spring. The males emerged in early August ; the wax deposit almost encircled the branches, was 3–5 mm. thick and contained 10–20 insects per sq. cm. In the field, the Coccids made good growth throughout the growing season, but produced no eggs in the spring, owing to parasitism.

Lepage (H. S.) & Giannotti (O.). **Cochonilhas da jaboticabeira.** [Coccids infesting the Jaboticaba Tree.]—*Biológico* **9** no. 7 pp. 169–173, 2 pls., 6 figs. São Paulo, 1943.

The more important of the Coccids that infest the jaboticaba tree [*Myrciaria jaboticaba*] in São Paulo are *Capulinia jaboticabae*, Iher., which is the commonest and most harmful of all and occurs under the bark of the trunk and branches, and even on the roots, *Saissetia discoides*, Hemp., which infests the trunks and is protected by ants, *C. crateraformans*, Hemp., *Takahashia pendens*,

Fonseca, *Edwallia rugosa*, Hemp., *Pseudokermes nitens*, Ckll., and *Ceroplastes janeirensis*, Gray, which infest the twigs and thinner branches, and *Pulvinaria eugeniae*, Hemp., *Pseudococcus grandis*, Hemp., and *Mycetaspis personata*, Comst., which occur on the leaves. Pruning infested twigs controls many of these Coccids, and the others can be killed by a spray of oil emulsion, after scraping the trunk and branches to expose the protected forms.

KAGAN (M.). **The Araneida found on Cotton in central Texas.**—*Ann. ent. Soc. Amer.* **36** no. 2 pp. 257–258, 3 refs. Columbus, Ohio, 1943.

A list is given of 36 spiders taken on cotton in central Texas during 1941–42, nine of which were observed to feed on insect pests of cotton. The insects concerned were adults and nymphs of *Adelphocoris rapidus*, Say, and *Psallus seriatus*, Reut., nymphs of *Aphis gossypii*, Glov., and larvae of *Heliothis armigera*, Hb., and *Alabama argillacea*, Hb. *Anthonomus grandis*, Boh., was not attacked.

MOTE (D. C.) & THOMPSON (B. G.). **Experiments with arsenical and non-arsenical Insecticides.**—*Proc. 6th Pacif. Sci. Congr. 1939* **6** pp. 129–134, 3 refs. Berkeley, Calif., 1943.

A brief account is given of investigations in Oregon on the control of *Bruchus pisorum*, L., on peas, the results of which have already been noticed [*R.A.E.*, A **27** 325], the codling moth [*Cydia pomonella*, L.] on apple and *Diabrotica undecimpunctata*, Mannh. (*soror*, Lec.) on beans. Tests during 1933–1938 of various substitutes for lead arsenate in sprays against *C. pomonella* in the Willamette Valley confirmed the results obtained in 1928–32 [**23** 406]. Calcium arsenate at the rate of 2 lb. per 100 U.S. gals. in the calyx spray and 3 lb. in the cover sprays, with the addition of 2 lb. hydrated lime, was the most effective of these materials; it gave 86·59 per cent. uninjured apples over the 10 years, as compared with 87·38 for lead arsenate, and did not injure either foliage or fruit, even when the lime was omitted. Excellent results were also obtained in commercial orchards in which calcium arsenate was substituted for lead arsenate over a period of six years.

Insecticides for use against *D. undecimpunctata* were tested in a field insectary in 1938 on adults collected in the field. Of those used as both sprays and dusts, the best, in order of efficiency, were pyrethrum extract, calcium arsenate and barium and sodium fluosilicates; the fluosilicates did not differ from one another. A rotenone dust was superior to any other dust except that containing pyrethrum extract, but a cubé spray was one of the less effective materials, which also included sprays and dusts of lead arsenate or sodium fluoaluminate, dusts of tartar emetic or nicotine sulphate and sprays of Bordeaux mixture.

STEWART (M. A.). **The Use of Methyl Bromide as a Fumigant.**—*Proc. 6th Pacif. Sci. Congr. 1939* **6** pp. 153–158, 17 refs. Berkeley, Calif., 1943.

DUDLEY (H. C.), SAYERS (R. R.) & NEAL (P. A.). **Bromide Content of certain Foodstuffs fumigated with Methyl Bromide II.**—*T.c.* pp. 159–163, 7 refs.

HAWKINS (L. A.). **Fumigation Practices with Methyl Bromide.**—*T.c.* pp. 165–166.

The first of these papers contains a review of the uses of methyl bromide as a fumigant against insects and other pests, its properties and mode of action, the precautions that should be observed in applying it, its effect on man, and the appropriate remedial treatment. The residues left on food-stuffs fumigated with methyl bromide are so slight as to be harmless to the consumer, and the risk

to operators applying it is not serious. The metal fittings of the fumigation chamber, which may be corroded by the methyl bromide, should be regularly inspected and care be taken as to where the gas is liberated after fumigation.

In the second, an account is given of studies on the absorption of methyl bromide by foodstuffs during fumigation, the results of which have already been noticed [*R.A.E.*, A **29** 444]. Preliminary tests indicated that the prolonged use of animal feeding stuffs fumigated with high concentrations of methyl bromide caused loss of weight, paralysis and death among animals but that the highest concentrations at present used commercially have no injurious effects.

In the third paper, methods of handling methyl bromide in commercial fumigation processes that have been developed to minimise risk to inexperienced operators are described.

VANDECAVEYE (S. C.). **Growth and Composition of Crops in Relation to arsenical Spray Residues in the Soil.**—*Proc. 6th Pacif. Sci. Congr. 1939* **6** pp. 217–223, 2 figs., 7 refs. Berkeley, Calif., 1943.

In the irrigated orchard districts of central Washington, the growth of field crops on soil previously under apple trees on which arsenical sprays have been extensively used has been unsatisfactory for periods ranging from one to several years after the removal of the trees. Investigations were therefore begun in 1935 to determine the cause of this and the value of various soil treatments in counteracting it. The content of readily-soluble arsenic expressed as arsenic trioxide varied from 16·3 to 1·1 parts per million on a dry basis in the top 6-inch layer of such soils and from 10·6 to 0·4 parts per million at 6–12 ins. With more than 2·5 parts in the top 6-inch layer, the leaf-tips of seedling barley and lucerne quickly turned yellow and later, in severe cases, the leaves dried and the plants died. Affected plants produced few fibrous roots, and the root-tips were partly rotted. The growth of older lucerne plants with roots that penetrated into the subsoil appeared to be normal. The severity of the symptoms was proportional to the concentration of soluble arsenic in the surface layer.

When barley was grown in pots of normal soil that had been treated with lead carbonate or arsenious acid, the former appeared to stimulate the plants, but the latter was toxic to them even at the low rate of 154 lb. per acre. The reduction in growth was in general proportional to the amount of arsenious acid and to the concentration of readily soluble arsenic present in the soil after equilibrium between it and the arsenious acid was reached. As little as 0·5 part soluble arsenic per million was toxic to the plants under these conditions.

The amounts of lead and arsenic absorbed by the roots increased with the amounts of soluble lead and arsenic in the soil ; relatively high concentrations of lead in the root tissues had no injurious effect and appeared to stimulate top growth, but much smaller amounts of arsenic were harmful to both roots and top growth. A relatively small proportion of lead and a larger one of arsenic passed from the roots to the aerial parts, but it was found that the latter can contain quantities of these substances in excess of the legal tolerances of 3·84 and 14·5 parts per million, respectively, when the soil has been heavily treated. The aerial parts of young lucerne plants 10 ins. high and of barley at the heading stage grown on soil contaminated with lead arsenate and containing 6·4 parts soluble arsenic trioxide per million in the top 6 ins. contained 54·4 and 20·8 parts arsenic trioxide per million, respectively ; the contents of the roots were 30·7 and 45·8 parts per million. Water grass (*Echinochloa crusgalli*) on the same soil and cut at the heading stage contained 25·6 and 398·0 parts arsenic trioxide per million in the aerial parts and the roots, respectively.

The effect of various compounds added to soil to render the accumulated lead arsenate unavailable to plants was tested with barley and lucerne in pots and in experimental plots, generally of lucerne. Iron compounds, especially the

oxidised forms, gave the most promising results ; iron (ferrous) sulphide and ferrous sulphate were about as effective as ferric sulphate in reducing the concentration of soluble arsenic in the soil, but less effective in improving the growth of the plants. Compounds of calcium, sodium, sulphur and aluminium were also of some value. The reduction in concentration of the soluble arsenic in the soil was roughly proportional to the rate of application of the iron compounds. The growth of lucerne receiving 1,500–3,000 lb. ferric sulphate per acre appeared to be normal and no toxic symptoms were observed, but yields on heavily contaminated soils were below normal even after the application of as much as 6,000 lb. per acre. The addition of large amounts of ferric or ferrous sulphate lowers the pH value of the soil, but even when lime was added to counteract this, yields were below normal. The beneficial effects of the iron compounds are thought to result primarily from the fixation of the soluble arsenic by the iron, 1 gm. of which is able to fix 2·5 mg. arsenic, and this is probably also responsible for the fact that the arsenic contents of plants grown on treated soil were reduced. The greater benefit from oxidised forms of iron is due to their ability to oxidise arsenites into arsenates, which are less toxic and less readily available to plants.

Wadley (F. M.) & Sullivan (W. N.). **A Study of the Dosage-mortality Curve.**—*J. econ. Ent.* **36** no. 3 pp. 367–372, 2 figs., 11 refs. Menasha, Wis., 1943.

The basic assumptions in the transformation of percentage mortality to probits and of concentrations to logarithms in the dosage-mortality curve [*cf. R.A.E.*, A **22** 440] are that increase in concentration takes effect logarithmically and that susceptibility is normally distributed among individuals. Since these assumptions indicate that 100 per cent. mortality will not be attained by any finite concentration and that zero mortality can occur only at zero concentration, and since the lower bend in the asymmetric sigmoid curve obtained with untransformed data is very poorly defined and there is a persistent deviation from linearity in the transformed curve, further investigations of these points were carried out. Statistical analysis of the results obtained when large numbers of house-flies [*Musca domestica*, L.] were treated with sprays of pyrethrum extract in acetone at a series of concentrations ranging from 0·031 to 5 mg. pyrethrins per cc., untreated flies and flies treated with acetone being used as controls, gave a strong indication of a definite threshold of toxic concentration, but the numbers of insects were insufficient for determining the significance of 100 per cent. mortality at the highest concentration. The lower bend in the asymmetric sigmoid curve was not well defined, and when spray concentrations were transformed to logarithms and percentages of mortality to probits, the data indicated significant and definite curvature, linearity being positively disproved in this material.

It is therefore concluded that the log-probit transformation is probably useful but not perfect, that extrapolation should be discouraged and that further study of the curve is justified.

Walkden (H. H.). **Cutworm and Armyworm Populations in Pasture Grasses, Waste Lands, and Forage Crops.**—*J. econ. Ent.* **36** no. 3 pp. 376–381, 3 refs. Menasha, Wis., 1943.

In view of the need for information on the source of the cutworms and armyworms that attack cereal and forage crops in the central Great Plains of the United States, infestation by which increased following the introduction of soil-conservation practices, a survey was made in 1937–40 of the Noctuid larvae occurring in 14 areas typifying the pastures, waste lands and forage crops of Kansas. Traps consisting of four thicknesses of burlap pegged down were

used to collect the larvae, most of which hide under shelter during the day, and allowed satisfactory estimates to be made of their comparative abundance in the various habitats. The number and species of larvae in the traps were recorded at intervals of 3–10 days from March or early April usually until late June. Of the 24 species taken, the most numerous, in order of decreasing abundance, were *Feltia subgothica*, Haw., *Peridroma saucia*, Hb. (*margaritosa*, Haw.), *Nephelodes emmedonia*, Cram., *Agrotis venerabilis*, Wlk., *Chorizagrotis auxiliaris*, Grote, *A. gladiaria*, Morr., and *Cirphis unipuncta*, Haw., which together constituted 97·7 per cent. of the total. The species of *Agrotis*, *Feltia* and *Chorizagrotis* were most abundant in March and early April, *Nephelodes* in late April and early May, and *Peridroma* and *Cirphis* in June. The populations were consistently low in well-managed pastures of blue-stem (*Andropogon scoparius*), native hay meadows and waste lands such as areas under dropseed (*Sporobolus heterolepis*) and panic grass (*Panicum virgatum*), and only three of the habitats selected were outstandingly favourable ; these were areas under little barley (*Hordeum pusillum*), blue-grass (*Poa* sp.) and sweet clover (*Melilotus* sp.), in which 53 per cent. of all the larvae collected were taken. The incidence of parasitism and disease increased among the larvae as the season progressed and was much greater in 1938 than in 1937. A list is given of the parasites that could be assigned to genus or species, with their hosts. No satisfactory method of evaluating the damage caused to the various types of grasses and forage plants was developed. It was not always directly proportional to the abundance of the larvae, but was largely governed by the ability of the vegetation to outgrow the effects of the attack.

Cook (W. C.). **Evaluation of a Field-control Program directed against the Beet Leafhopper.**—*J. econ. Ent.* **36** no. 3 pp. 382–385, 6 refs. Menasha, Wis., 1943.

Part of an extensive campaign that has been carried out since 1931 for the control of the beet leafhopper, *Eutettix tenellus*, Baker, in central California consists in spraying it on its autumn and winter food-plants with a diesel oil containing pyrethrum extract [*cf. R.A.E.*, A **30** 548, etc.], but it is very difficult to ascertain the effect of this spraying on the population in the following year. It is useless to leave small unsprayed areas for comparison as leafhopper migration occurs throughout the winter, and unsafe to leave large ones. The size of the spring population depends on that of the late summer population, which itself depends on the abundance of available food-plants and the concentration of leafhoppers on them, and it is affected by the autumn and winter mortality ; none of these factors was accurately measured in the period before spraying was initiated. Also, reliable data on the density of the spring population in the beet fields are available only for the period 1930–41, and only the first two of these years preceded the spraying campaign. It cannot, therefore, be used as a direct measure of the value of spraying. Estimates based on the incidence of curly-top disease [*Chlorogenus eutetticola* of Holmes] or on yield are subject to the same disadvantages, and, furthermore, the percentage of infected plants depends not only on the number of leafhoppers entering the beet fields, but also on the percentage of these that carry the virus, which is extremely variable, and the yield may be affected by other factors. Estimating the potential spring generation from the proportion of females that survive spraying is shown to be complicated by the fact that the spray may tend to kill those that are stronger or weaker than the average and that a release of population pressure may increase the subsequent rate of increase and survival.

When large areas are considered, the factors of size and situation of individual breeding areas assume importance ; although the exact distribution of leafhoppers after a migration is not known, it may be assumed that the contribution of a breeding area to the population in beet fields will be directly proportional

to the number of leafhoppers in it and inversely proportional to some function of its distance from the beet fields. It is suggested that on the basis of intensive field studies, it may be possible to estimate a maximum safe population for each breeding area, below which spraying must reduce the population if it is to be effective.

JOHNSTON (H. R.). **Laboratory Tests of Termite Shields.**—*J. econ. Ent.* **36** no. 3 pp. 386–392, 1 fig. Menasha, Wis., 1943.

The following is substantially the author's summary. Laboratory tests were made of various types of termite shields to determine which shape would be most effective in preventing the eastern subterranean termite, *Reticulitermes flavipes*, Koll., from constructing tubes up to the woodwork of a building and to determine the fundamental principles that influence their effectiveness. Sample shields were fastened on top of piers or cans, and the soil in which the piers were set or that was put into the cans was artificially infested with termites. Every type of shield tested was crossed at least once by a termite tube. The form that proved most effective was that having a projection of 2 ins. horizontally and an additional 2 ins. downward at an angle of 90°, but this type is difficult to construct and instal properly. Smoothness of the surface and thin edges aided in stopping tube building [*cf.* *R.A.E.*, A **31** 317], but if thin, smooth edges are in contact with wood or other objects, their deterrent effect is nullified.

Since no type of shield yet devised has been found entirely effective, it is necessary to make occasional inspections of all shields. A simple shield of 26-gauge galvanised iron that projects at least 2 ins. from the foundation and is bent downwards sufficiently to break contact between the edge of the shield and the woodwork of the building affords as much protection as the standard types with the edge bent down at an angle of 45° and is more economical to construct and instal.

MORRILL jr. (A. W.). **The Control of *Limonius agonus* (Say) on Shade-grown Tobacco in Connecticut, 1937–42.**—*J. econ. Ent.* **36** no. 3 pp. 392–395, 2 figs., 7 refs. Menasha, Wis., 1943.

The eastern field wireworm, *Limonius* (*Pheletes*) *agonus*, Say, which was formerly considered to be identical with *L.* (*P.*) *ectypus*, Say, has become increasingly prevalent on potato and tobacco in Connecticut, and may be found in many fields at any season of the year. The larvae come up into the top soil in greatest numbers at about the middle of April and remain there until the end of June. They damage newly set tobacco plants, and the injury is much more severe in fields planted with a cover crop of oats, which do not live over winter, than in those planted with rye, which does. Of the experiments described on the control of this wireworm on shade-grown tobacco in 1937–42, those of 1937 and 1938 gave inconclusive results and those of 1939 and 1940 have already been noticed [*R.A.E.*, A **30** 40, 222]. In 1941, thorough aeration of the soil by double ploughing before the application of naphthalene [*cf.* **30** 223], the application of dichloroethyl ether or p-aminoacetanilide in the setting water, deep ploughing in autumn, and the injection of 1 oz. carbon bisulphide into the soil, to a depth of 4 ins. at intervals of 18 ins., after harvest were compared. Naphthalene again caused a reduction of the population that was significant but insufficient to be of practical value [*cf.* **30** 40], dichloroethyl ether was sufficiently effective to suggest the desirability of further tests and p-aminoacetanilide was apparently without effect. The value of deep ploughing in autumn could not be measured after only one season, but carbon bisulphide caused a reduction of 87 per cent. in the wireworm population in September, and no wireworms were found at setting time in the following spring. It is therefore concluded that in a field threatened with wireworm attack, the use of

carbon bisulphide immediately after harvest, when the soil is still warm and the wireworms are near the surface, will probably destroy the greater part of the population.

GIBSON (A. L.). **Penetrating Sprays to control the Mountain Pine Beetle.**—*J. econ. Ent.* **36** no. 3 pp. 396–398, 1 ref. Menasha, Wis., 1943.

Felling and barking or burning infested trees or burning them standing give effective control of *Dendroctonus monticolae*, Hopk., in lodgepole pine [*Pinus contorta*] in the United States, but are expensive and, owing to the danger of fire, must be confined to periods when weather, transport and working conditions are adverse. Penetrating sprays were therefore tested in 1934–38 in Montana, Idaho and Wyoming [*cf. R.A.E.*, A **26** 394]. Only trees and logs that contained abundant brood were used, and to ensure thorough coverage, spraying was continued until the liquid on the bark surface glistened and began to flow; this occurred when approximately 90 sq. ft. of surface had received 1 U.S. gal. spray. Various petroleum derivatives and water were tested as carriers of the lethal materials, but only the oils gave satisfactory results and these showed little difference in effectiveness; the addition of wetting agents did not result in consistently better control. Formulae that gave over 90 and over 95 per cent. brood reduction are given in a table with their cost. In 1939–40, the most effective sprays were tested on infested whitebark pine [*P. albicaulis*], which is an alternative food-plant and often grows near stands of lodgepole pine, and gave satisfactory control whether the beetles were in early or advanced stages of development. It was found that effective control of insects under green or wet bark, which is often found at the base of infested trees, can be expected, but that the survival of a small percentage in treated trees is likely in wet areas.

Sprays containing 1 U.S. gal. orthodichlorobenzene (Orthene) and 3 lb. naphthalene flakes in 3 or 4 U.S. gals. diesel oil combined effectiveness of control and low cost more than any others tested and gave the most satisfactory results during late spring, when working conditions are most favourable and present methods cannot be used for fear of fire. It is considered that lower operational costs, due to this factor and to the long period during which spraying can be carried out, will largely compensate for the high cost of the materials used.

WOLFENBARGER (D. O.) & JONES (T. H.). **Intensity of Attacks by *Scolytus multistriatus* at Distances from Dispersion and Convergence Points.**—*J. econ. Ent.* **36** no. 3 pp. 399–402, 4 refs. Menasha, Wis., 1943.

It has been shown that crotch-feeding by *Scolytus multistriatus*, Marsh., which may result in the inoculation of healthy elm trees with *Ceratostomella ulmi*, the fungus that causes Dutch elm disease, decreases with increasing distance from the point of emergence of the beetles and from logs to which the beetles converge for breeding [*cf. R.A.E.*, A **26** 551; **29** 163], and experiments were therefore carried out in New Jersey in 1940 and 1941 to ascertain the percentages of twig crotches injured round a source of emerging beetles (dispersion point), round trap trees to which beetles came to breed (convergence points), and round a point where beetles emerged and trees suitable for breeding were immediately available, and the numbers of brood galleries in trap trees at different distances from the source of beetles. In rural areas containing moderate numbers of elms, but no breeding material or source of beetles other than those in the experimental materials, infested logs and recently cut elm trees, ranging from 5 to 7 ins. in diameter at breast height, were placed among stands of small elm

saplings that were 1–4 ins. in diameter 6 ins. above soil level. Most of the beetles emerged during August, when the trap logs were exposed to attack; after six weeks the area of the latter was measured and they were stripped of bark and examined for brood galleries, and sample trees round the dispersion and convergence points were examined for injured twig crotches. A study of the data showed no significant directional effect. The percentage of twig crotches injured decreased from 39·3 within 25 ft. of the dispersion point to 1·9 at a distance of 25–75 ft. in 1940 and from 36·4 within 25 ft. to 15·7 at 25–50 ft. and 2·3 at 50–75 ft. in 1941. Examination of 20 trees within 50 ft. of each trap tree showed an irregular decrease in the estimated percentage of beetles making wounds and of twig crotches injured as the distance from the dispersion point increased, the latter appearing to be more closely related to the distance from the dispersion point than to the estimated number of beetles breeding. Where infested logs and trap logs were close together, the concentration of injuries was similar to that about infested logs only, suggesting that beetles attack twig crotches near their point of emergence, regardless of the immediate proximity of breeding material. Most brood galleries were found in the trap trees nearest the source of infestation, but some were found nearly three-quarters of a mile away, and statistical examination of the results suggests that they might occur as much as four miles away.

McPhail (M.). **Linseed Oil Soap—a new Lure for the Melon Fly.**—*J. econ. Ent.* **36** no. 3 pp. 426–429, 1 fig., 3 refs. Menasha, Wis., 1943.

The following is based on the author's summary. In the course of laboratory and field investigations carried out in Hawaii in which males of the melon fly, *Dacus cucurbitae*, Coq., were found to be attracted to blossoms of a common orchid, the inclusion of linseed-oil soap in the traps to soften the water so that captured flies would drown more readily led to the discovery that this soap is a strong attractant for both sexes. Comparison with other common soaps showed that linseed-oil soap was the most effective, though cottonseed-oil soap and maize-oil soap were attractive. The results of limited investigations suggested that the attractive component might be a fatty acid.

Attempts to protect a plot of bitter melons by trapping the flies with linseed-oil soap were unsuccessful owing to rapid reinfestation both from outside the plot and from within it.

van Leeuwen (E. R.). **Chemotropic Tests of Materials added to standard Codling Moth Bait.**—*J. econ. Ent.* **36** no. 3 pp. 430–434, 5 refs. Menasha, Wis., 1943.

The preliminary results are recorded of experiments carried out in Washington in 1933–39 to find suitable attractants for addition to the fermenting molasses baits used as a supplementary measure against *Cydia* (*Carpocapsa*) *pomonella*, L. A pan of the standard bait (a 10 per cent. solution of molasses with yeast) and one of the test bait, which was the same except for the addition of a chemical in an evaporation cup floating on the solution, were hung a few inches apart in an apple tree. About 50 of some 240 organic and inorganic compounds tested increased the attractiveness of the molasses bait by 50 per cent. or more, the most effective being safrole (450 per cent.), n-butyl sulphide (422·1 per cent.) and pine-tar oil (326·9 per cent.), and others decreased its attractiveness by masking its odour or by repelling the moths. In a number of additional tests, pine-tar oil gave marked increases in catch over the standard bait when added directly to the solution, the mixture being much superior to either material used alone.

STEINER (L. F.) & SUMMERLAND (S. A.). **Xanthone as an Ovicide and Larvicide for the Codling Moth.**—*J. econ. Ent.* **36** no. 3 pp. 435–439, 3 refs. Menasha, Wis., 1943.

Preliminary studies carried out at Vincennes, Indiana, in 1940 and 1941 on xanthone, applied in regular cover sprays to apple trees on which eggs of the codling moth [*Cydia pomonella*, L.] had been or were subsequently deposited by caged moths indicated that early in the season this material has some value as an ovicide. A spray of 2 lb. xanthone, 4·5 oz. zinc sulphate and 1·7 lb. sodium oleate per 100 U.S. gals. killed 73 and 72 per cent. of eggs deposited on the two days before and the two following spraying, respectively, whereas one of 4 lb. lead arsenate, 0·75 lb. copper sulphate, 1·5 lb. lime and 2 U.S. quarts mineral oil per 100 U.S. gals. killed 31 and 11 per cent., and one of 1 U.S. pint nicotine sulphate, 5 lb. bentonite, 1 lb. sodium oleate and 2 U.S. quarts mineral oil per 100 U.S. gals. killed 10 per cent. in each case. The corresponding larvicidal efficiencies were 12 and 31, 31 and 54, and 53 and 69 per cent. The xanthone spray killed 33·7 per cent. of the eggs deposited between 22nd July and 11th August, during which period two applications were made; two sprays of 0·67 pint nicotine sulphate per 100 gals., with 3 quarts mineral oil in the first and 2 quarts in the second, killed only 25·5 per cent. during the same period. Xanthone, which shows poor resistance to weathering, was most effective against eggs laid soon after spraying, probably because they protected the deposit under them, whereas the nicotine spray gave better results against eggs that had reached an advanced stage at the time of spraying. Xanthone was more effective on foliage, where as many as 94 per cent. of the eggs may be laid, than on fruit, where its deposits appeared lighter, but nicotine with oil was more effective on fruit than on foliage, presumably because penetration and loss of the oil from other causes was more rapid from the leaf than from fruit surfaces. The percentage mortalities of eggs deposited before and after spraying on 9th June were 56·9 and 65·7 for 2 lb. xanthone, 1 U.S. quart kerosene, 3 oz. soap and 2 oz. zinc sulphate per 100 U.S. gals. and 29·9 and 14·7 for 4 lb. lead arsenate, 0·75 lb. copper sulphate, 1·5 lb. lime and 2 U.S. quarts mineral oil per 100 U.S. gals. The corresponding larvicidal efficiencies were 30 and 68·2, and 30 and 42·1 per cent. However, counts at harvest indicated that xanthone was less effective than lead arsenate as sole protection against larvae of the second and third generations, allowing 13 entrances per 100 apples as compared with 3·2 per 100, the low resistance to weathering during the long period between the final cover spray and harvest rendering the fruit sprayed with xanthone very susceptible to attack resulting from interplot migration of the moths. In areas where there are three generations a year and the incubation period is as short as five days and eggs may be deposited daily from early May to October, and where high temperatures shorten the effective period of oil sprays, ovicidal sprays are likely to be less useful than in two-generation areas.

CRESSMAN (A. W.) & BROADBENT (B. M.). **Effectiveness of Cube and Derris Resins in a Tank Mix and an emulsive Oil against California Red Scale.**—*J. econ. Ent.* **36** no. 3 pp. 439–441, 9 refs. Menasha, Wis., 1943.

Experiments carried out in 1939 and 1940 with sprays containing 1·5 per cent. of a light-medium commercial emulsive oil, said to contain 1 per cent. glyceryl oleate, for the control of the California red scale [*Aonidiella aurantii*, Mask.] on *Citrus* in California showed that the addition of 0·51, 0·76 and 1·52 per cent. cubé resins containing 28 per cent. rotenone, a mixture of dibutyl phthalate and trichloroethylene (2 : 1) being used as an intermediary solvent, increased the percentage mortality from 45 to 60, 84 and 98. Similar results were obtained with sprays containing 1, 1·5 and 2 per cent. medium oil and 0, 0·47, 0·76, 1·52 and 2·27 per cent. cubé resins.

In 1941, experiments were carried out with derris resins containing 33 per cent. rotenone and with more volatile petroleum fractions, used as tank-mixed oils, with 4 oz. blood-albumin spreader per 100 U.S. gals. Since sprays of 5 per cent. kerosene containing 5 per cent. by volume of the mixture of dibutyl phthalate and trichloroethylene caused considerable defoliation, this was replaced by Cardolite [*cf. R.A.E.*, A **31** 491]. The percentage mortalities were 64, 90·1 and 93·2 for concentrations of 0, 0·5 and 1 per cent. derris resins in a spray of 2 per cent. light oil, 34·7, 74·1 and 73·1 for 0, 0·2 and 0·4 per cent. in 5 per cent. kerosene, and 92·8, 99·3 and 99 for 0, 0·33 and 0·67 per cent. in 3 per cent. of an intermediate fraction, indicating that the addition of derris resins increased the mortality, but that doubling the concentrations produced no further increase. Comparison of sprays of 1·75 per cent. tank-mixed medium oil containing 0·57 and 1·14 per cent. derris resins, with Cardolite or the mixture of dibutyl phthalate and trichloroethylene as the intermediary solvent, showed no significant difference in oil deposit or percentage mortality of scales between concentrations of derris resins or between the solvents.

The contrast in the effect of increasing the resin content of emulsive and tank-mixed oils was confirmed by small-scale tests. An emulsive oil with the addition of 1·14 per cent. derris resins gave significantly higher kill than the same oil with 0·57 per cent., whereas a corresponding tank-mixed oil showed no significant difference between these concentrations. Mortalities were higher with 0·57 per cent. resins than with 0·28 per cent. in both oils, but not significantly so. The amount of oil deposited did not differ significantly, but in every case the emulsive oil was more effective than the comparable tank-mixed oil. There was no significant difference in control when 0·57 and 1·14 per cent. derris resins were added to a light-medium oil that was applied as a tank-mixed oil at 1·5 per cent. without blood-albumin spreader, but the higher concentration was significantly the more effective when the oil was mixed with 1 per cent. glyceryl monooleate (by volume) to make an emulsive oil, which was applied at a concentration of 1·75 per cent. Evidently the failure to improve mortality when the concentrations were increased above some undetermined optimum was not dependent on the blood-albumin spreader; the difference in behaviour of the two types of oil may be related to a change in the physical properties of the oil caused by the oil-soluble emulsifier.

BOHART (R. M.). **Calcium Cyanide Fumigation for the Western Thrips.**—*J. econ. Ent.* **36** no. 3 pp. 442–444. Menasha, Wis., 1943.

The most serious pests of carnations and roses grown in greenhouses in California are thrips, particularly *Frankliniella occidentalis*, Perg., *F. minuta*, Moult., and *Thrips tabaci*, Lind.; *F. occidentalis*, with which *F. moultoni*, Hood, is here considered to be identical, greatly predominates. In preliminary tests in a reasonably gas-tight greenhouse, overnight fumigation with hydrocyanic acid gas liberated from Cyanogas G-fumigant, which was used at the rate of 0·5 oz. per 1,000 cu. ft. and is stated to contain not less than 42 per cent. calcium cyanide, apparently gave good control of thrips on mixed varieties of carnations, but injured the plants to degrees that differed considerably with different varieties. The injury may have been due to the fact that no precautions were taken with regard to withholding irrigation water before treatment. In further tests in 1942, in which blossoms of common mustard (*Brassica* spp.) that harboured numerous individuals of *F. occidentalis* were picked and immediately fumigated in open glass containers in empty greenhouses with dosages of 0·375, 0·5, 0·75 and 1 oz. Cyanogas per 1,000 cu. ft. for 3 hours or overnight, there was a considerable range of mortality at any given dosage owing to differences in volume and leakage in the greenhouses and varying temperature and humidity, but it was found that the larvae were much more resistant than the adults; that mortality was low at 0·375 oz. Cyanogas;

that overnight fumigation gave much higher kills than exposure for 3 hours ; and that high adult mortality occurred at dosages as low as 0·75 oz. for 3 hours (59·4–78·4 per cent.) or 0·5 oz. overnight (85·9–98·5 per cent.). It is concluded that during periods of heavy infestation, fumigation once or twice a week with 0·75 oz. Cyanogas per 1,000 cu. ft. for 3 hours should give adequate control of *F. occidentalis* in a reasonably gas-tight greenhouse and should not result in objectionable plant injury if proper precautions are observed. However, before this treatment can be used on a large scale, more information is needed on the varietal response of carnations to cyanide fumes and the effects of humidity, temperature and post-shading.

SMITH (F. F.). **Substitutes for Tartar Emetic and brown Sugar in the Control of the Gladiolus Thrips.**—*J. econ. Ent.* **36** no. 3 pp. 445–452, 10 refs. Menasha, Wis., 1943.

In 1942, greenhouse and field experiments on the control of *Taeniothrips simplex*, Morison, on gladiolus were carried out with tartar emetic, used at the rate of 2 lb. per 100 U.S. gals. spray, and possible substitutes for it that have been shown to be relatively effective, combined with molasses and syrups that are available in various parts of the United States.

The following is based on the author's summary. All quantities given are those used per 100 U.S. gals. spray. Tartar emetic (2 lb.) was equally effective when combined with 4 lb. brown sugar or with maize syrup, cane molasses or blackstrap molasses, diluted to give similar sugar contents in the finished spray, and sodium antimony lactophenolate at 8 lb. was almost as effective with the same materials. Sprays containing 1 U.S. quart nicotine sulphate with 3 U.S. gals. maize or cane syrup were more effective than one of tartar emetic with 4 lb. brown sugar on a susceptible variety of gladiolus, and 1 U.S. quart nicotine sulphate with 3 U.S. quarts maize syrup appeared to protect a moderately resistant variety adequately. Nicotine sulphate was also highly effective with 2 U.S. quarts maple syrup or 3 U.S. gals. honey, but gave poor control with blackstrap or maize molasses, which apparently caused rapid evolution of nicotine fumes, possibly decreasing the residual action of the nicotine. Minimum effective concentrations have not been established for all syrups. Lead arsenate was less effective than tartar emetic or nicotine sulphate when combined with brown sugar, syrups or molasses, injured the foliage and flower petals showing colour, and caused a reduction in the increase of corms. Paris green (0·4 lb.) was very effective with 3 U.S. gals. maize syrup or 2 U.S. quarts blackstrap molasses and less injurious than when used with larger quantities of molasses. The addition of hydrated lime or magnesium hydroxide to sprays of Paris green reduced foliage injury but also their effectiveness against the thrips. Sorbitol and isoamyl salicylate, tested as substitutes for sugar, and xanthone, phenothiazine and two thiocyanates, tested as substitutes for tartar emetic, were ineffective.

Sooty fungus developed on foliage sprayed with combinations of nicotine sulphate or tartar emetic and blackstrap molasses, but not on that treated with sodium antimony lactophenolate and the same molasses. The addition of 0·8 lb. sodium benzoate to the nicotine or tartar-emetic sprays prevented fungus growth.

HOLLOWAY (J. K.) & YOUNG jr. (T. R.). **The Influence of fungicidal Sprays on entomogenous Fungi and on the Purple Scale in Florida.**—*J. econ. Ent.* **36** no. 3 pp. 453–457, 6 refs. Menasha, Wis., 1943.

A brief account is given of experiments carried out in 1938–39 to ascertain the influence of fungicidal sprays on populations of the purple scale [*Lepidosaphes beckii*, Newm.] on orange in Florida, where the climate is favourable to the

growth of entomogenous fungi. Leaves about 18 months old or less, adjacent to spring flush growth, were selected and the numbers of scales killed by fungi, dead through other causes and living were counted. Some trees were left unsprayed, and others were sprayed on 20th April and 8th July 1938 with 6 lb. aluminium sulphate and 6 lb. hydrated lime, 1 lb. cupric carbonate and 9 U.S. pints ammonia or 6 lb. copper sulphate and 6 lb. hydrated lime per 100 U.S. gals. water. The trees were classified as those receiving light inert residues (no treatment and treatment with cupric carbonate) or heavy inert residues (aluminium or copper sulphate and lime) and as those receiving or not receiving copper. Examination in August showed that total infestation was higher and total mortality lower on trees with heavy residues than on those with light ones, but that neither was affected by the presence of copper ; although the fungicidal sprays almost entirely eliminated the infestation of the scale by entomogenous fungi, the absence of fungi did not cause any measurable difference in scale population at each level of residue.

No sprays were applied after July 1938, but in August 1939, total infestation was still significantly greater on trees that had received heavy residues than on those that had light ones and showed no difference between trees that had or had not received copper. Spraying in July 1938 with spores of *Nectria diploa* and *Sphaerostilbe aurantiicola* suspended in water caused no significant increase in the percentage of the scale infested by fungi, and there was no difference in percentage infestation between 1938, when rainfall was very light, and 1939, when it was heavy. Total mortality was greater in 1939 than in 1938, possibly because the heavy showers kept the leaves free of dust, and, as a result of this and the dropping of many heavily infested leaves from the trees with heavy residue during the winter months, total infestation was lower.

Yust (H. R.) & Busbey (R. L.). **Influence of Moisture and Field Dust on the Susceptibility of the California Red Scale to HCN.**—*J. econ. Ent.* **36** no. 3 pp. 457–460, 4 refs. Menasha, Wis., 1943.

The author describes a series of laboratory tests carried out in California in which lemon fruits that had been infested in the laboratory with *Aonidiella aurantii*, Mask., of a relatively resistant strain, were fumigated for 40 minutes with hydrocyanic acid gas after being covered with a film of water or dusted with fine orchard soil. Second-moult scales (20 days old) were fumigated at 77 and 59°F., with concentrations that killed 89·2 and 96·9 per cent. on clean dry fruits, and mature females (35 days old) at the same temperatures with concentrations that killed 67·6 and 72·2 per cent. The insects treated at 59° were kept at that temperature for four hours before and after treatment. In each test, significantly better kills were obtained on wet than on dry fruits, regardless of whether they were clean or dusted. A greater amount of water on the surface increased the kill of the mature females, but not of the second-moult scales, and moisture influenced the kill less at 59 than at 77°F. There was a tendency towards lower kills on dusted dry fruit than on clean dry fruit, but the difference was significant only in the treatment of mature females at 59°. The amount of dust was unimportant.

When lemons bearing mature females were left out of doors and fumigated during the night at 61°F., mortality was significantly higher on those on which dew had been allowed to collect than on those that had been covered with wax-impregnated muslin, and the kill was also significantly higher on fruit that was immersed in water immediately before fumigation than on dry fruit, though the difference was less than in previous experiments, probably because there was less water on the fruit. When second-moult scales were exposed on wet and dry fruits for 10, 20, 40 and 60 minutes at 77°F. to constant concentrations giving approximately 75–96 per cent. mortality, moisture increased the kill at all exposures. Mature females on dry and very wet fruits that were prefumigated

for eight minutes with 0·14 mg. HCN per litre and fumigated immediately after with a constant concentration of 0·6 mg. per litre at 77°F., simultaneously with mature females that had not been prefumigated, showed protective stupefaction on both wet and dry fruits, but in spite of this, significantly better kill was obtained on wet than on dry fruits.

WOLCOTT (G. N.) & MARTORELL (L. F.). **Control of the Sugarcane Borer in Puerto Rico by Laboratory-reared Parasites.**—*J. econ. Ent.* **36** no. 3 pp. 460–464. Menasha, Wis., 1943.

In view of the failure to control *Diatraea saccharalis*, F., on sugar-cane in Porto Rico by chemical or cultural methods or by the introduction of parasites, extensive observations were made over five years on the seasonal abundance and natural parasitism of the eggs of the borer in all parts of the island, and for three years experiments were carried out to determine the effect of rearing the native *Trichogramma minutum*, Ril., in the laboratory and releasing it in large numbers in various localities at different times of year. Of the two parasites of the eggs that occur in Porto Rico, *Telenomus* (*Prophanurus*) *alecto*, Crwf., is of little economic importance, but *Trichogramma* occurs in all parts at all times of the year; moreover, it was found that almost 20 per cent. of the eggs are destroyed by *Monomorium carbonarium ebeninum*, Forel, which is most numerous where the parasites are normally least abundant. The seasonal history of *Diatraea* in different parts of the island and its effect on parasitism by *Trichogramma* is discussed in some detail, and a table is given showing the results of 37 experiments on the release of the parasite, based on the rates of parasitism in comparison with those in control fields. In general, natural parasitism is high in the fields with most egg-clusters, but in a region where most fields have many egg-clusters and high parasitism, one or more fields with comparable abundance of egg-clusters may have little or none, and releases in such fields have invariably been successful, usually resulting eventually in higher parasitism than the average in the other fields. The same conditions are favourable for oviposition by the host and for the parasite, and liberations in districts in which the number of fresh egg-masses is steady or increasing are likely to be successful, whereas in those in which they are decreasing, liberations may result only in temporary parasitism in the field of release. It is calculated that success is unlikely if less than five fresh egg-clusters are found in a field in an hour and cannot be proved if natural parasitism is over 33 per cent. Fields with conditions more or less promising for release represented 12·4 per cent. of the fields of plant cane and 6·4 per cent. of those of ratoon cane surveyed, but no indication was found by which their occurrence could be predicted without continued inspection of all fields. Very few such fields were found between April and August, but they averaged 10 per cent. in September and October, 14 per cent. in December and 12 per cent. in February and March. They were much more numerous in some localities than in others, and observations indicated a strong probability that during the autumn, winter or early spring, 20–25 per cent. of the fields in Ponce, Santa Isabel and Guanica are suitable for the release of parasites and that at most localities on the eastern and northern coasts only slightly fewer are suitable.

MARSHALL (G. E.). **The Control of the Oriental Fruit Moth by mechanical Means.**—*J. econ. Ent.* **36** no. 3 pp. 468–469. Menasha, Wis., 1943.

Regular clipping and destruction of infested peach twigs and removal of infested fruits gave satisfactory control of the oriental fruit moth [*Cydia molesta*, Busck] on mid-season varieties of peach in Indiana [*cf. R.A.E.*, A **31** 314], but when a block of a variety that ripens towards the end of September, surrounded by early and mid-season varieties, was treated in 1938, 98 per cent.

of the fruits were infested at harvest. It was concluded that this method of control is ineffective on late peaches that are not sufficiently isolated to eliminate migration of moths from other trees, and further tests were carried out on mature trees of a variety ripening in October that were about half a mile from any other peaches. Infested twigs and peaches were removed 20 times during the season and the percentages of all fruits and harvested fruits infested were 38·2 and 30·2, whereas on trees of the same variety that set a full crop of fruit and received three oil-dust sprays but no clipping, all but about 50 peaches per tree were infested. If clipping is carried out, the normal schedule for peaches in Indiana of six sprays or dusts may be reduced to three, lead arsenate for control of the curculio [*Conotrachelus nenuphar*, Hbst.] may be omitted from another, and no special thinning is necessary.

FLANDERS (S. E.). **The Susceptibility of parasitic Hymenoptera to Sulfur.**—*J. econ. Ent.* **36** no. 3 p. 469, 3 refs. Menasha, Wis., 1943.

In investigations carried out in California in 1942, adults of *Metaphycus helvolus*, Comp., that were allowed to move a few times over leaves of *Citrus* picked from a tree that had received a commercial dusting with sulphur on 6th May died within 24 hours. The tests were repeated once a week for three months, and the toxicity of the sulphur gradually decreased until it was no longer lethal to adults by 10th August. However, when these parasites were confined on the leaves for several hours and then put with a number of black scales [*Saissetia oleae*, Bern.] suitable for attack they failed to recognise them as hosts in which to oviposit and never recovered the ability to do so. The susceptibility of the parasite to sulphur increased noticeably at temperatures above 80°F.; below 75°F. no injurious effects were noted. The liberation of large numbers of *M. helvolus* on a tree that had been dusted with sulphur a week earlier resulted in complete mortality, and it is evident that where the parasite is present only in the adult stage during several months of the warm season, treating large areas of vegetation with sulphur may result in the destruction of numbers sufficient to prevent them from checking the increase of *S. oleae*; *M. helvolus* is particularly susceptible since it moves rapidly over wide areas.

BRANNON (L. W.). **The comparative Suitability of Potato and Tobacco as Hosts of the Potato Tuber Worm.**—*J. econ. Ent.* **36** no. 3 pp. 469–470, 1 ref. Menasha, Wis., 1943.

In view of the fact that the potato tuber worm, *Gnorimoschema operculella*, Zell., commonly occurs in tobacco in several of the tobacco-growing States, laboratory tests were made to obtain additional information on the effect of the food-plant on moth production. In September–October 1942, 66 moths from potato and the same number from tobacco, obtained from South Carolina, were put in separate cages containing new potatoes. The first stages of the next generation were first observed on 29th October and 3rd November, respectively, and examination on 25th November showed totals of 1,135 and 327 progeny, indicating that moths reared on potatoes reproduce more readily on potatoes than do those reared on tobacco.

WALKDEN (H. H.). **Differential Damage to Sweetclover Varieties by the Variegated Cutworm.**—*J. econ. Ent.* **36** no. 3 p. 470. Menasha, Wis., 1943.

In the course of an outbreak of *Peridroma saucia*, Hb. (*margaritosa*, Haw.) that occurred on test plots of sweet clover [*Melilotus*] in the second year of growth in Kansas in June 1937, it was observed that the different varieties were

damaged in varying degrees, and the differences in extent of defoliation were outstanding by the time that the larvae had finished feeding in July. Estimates of the percentage defoliation of 28 varieties are shown in a table. They ranged from 25 to 90. In general, varieties with white flowers showed less defoliation than those with yellow flowers, and those that matured early were the more severely damaged. Small plants in an adjacent plot were not injured.

Bailey (J. S.) & Bourne (A. I.). **An unusual Type of Ethylene Dichloride Injury to Peach.**—*J. econ. Ent.* **36** no. 3 pp. 470–471, 1 fig. Menasha, Wis., 1943.

The author describes an unusual type of injury that began to appear on 7th October 1941 in a three-year-old peach orchard in Massachusetts that was treated with a 15 per cent. emulsion of ethylene dichloride at the rate of 0·5 U.S. pint per tree on 1st and 2nd October ; the temperature reached 82, 88 and 77°F. on 4th, 5th and 6th October, respectively. The injury consisted in the dying of the tips of very vigorous immature shoots about 4 ft. long, which had developed from the crowns of trees cut to the ground after winter damage ; although the shoots grew from the old trunks well below the soil surface, there was no injury either at or below ground level. It is pointed out that the dosage, adjusted for three-year-old trees [*cf. R.A.E.*, A **31** 484, etc.], was excessive for tissue less than one year old ; that unseasonably high temperatures occurred a few days after treatment ; that there was considerable odour of ethylene dichloride in the soil ; and that the affected tissues were very succulent, immature and above ground. The injury undoubtedly resulted from the rapid volatilisation of the fumigant, and it is considered surprising that there was no injury below ground, where the concentration of gas was probably high.

Cockerham (K. L.). **The Host Preference of the Sweetpotato Weevil.**—*J. econ. Ent.* **36** no. 3 pp. 471–472. Menasha, Wis., 1943.

A list is given of the numerous species of *Ipomoea* in which *Cylas formicarius* subsp. *elegantulus*, Summers, was found breeding in the course of a survey of experimental plots, sweet-potato farms and other environments, such as marshes and seashores, made in Louisiana in 1940. The investigations were carried out to obtain further data on the rôle of wild food-plants in building up populations of weevils on farms and to determine more specifically the preference they show for the various plants. In field-plot tests in which sweet potatoes and five of the most common wild food-plants were compared, significantly greater numbers of weevils developed in the vines and crowns of the sweet potatoes than in the wild plants, and there were still more weevils in the tubers of the sweet potatoes. In field-cage tests with large and small plants of both sweet potato and *I. hederacea* var. *integriuscula*, the most attractive of the wild food-plants, adults showed a decided preference for the larger plants ; when small plants of the two species were caged together, less feeding occurred on sweet potato. Under normal conditions, the sweet potato plants grow larger than any of the wild plants, but this may not happen where the latter are favoured by cultivation or growing in unusually fertile locations, and these studies emphasise the importance of wild food-plants, since it is evident that weevils can breed abundantly in them on farms where the sweet potato is suppressed as a control or eradicative measure.

List (G. M.). **A portable Spray Boom for experimental Plots.**—*J. econ. Ent.* **36** no. 3 p. 472, 2 figs. Menasha, Wis., 1943.

The author describes a spray boom that can be used to approximate field spraying in randomised plots without excessive driving through the field. It

sprays a single row with a nozzle arrangement identical with that of the field sprayer booms, but is supported on a 10-ft. pipe carried by two men, the pressure being supplied from a machine at the end of the plot through a high-pressure hose. Methods of using the boom and suitable arrangements of plots are described. This apparatus has given satisfactory results for two seasons in spraying experimental plots of beans and potatoes ; the desired rate of application can be obtained more accurately than with a horse- or tractor-drawn sprayer.

SIEGLER (E. H.) & GERTLER (S. I.). **Tests of N-substituted P-Bromobenzenesulfonamides against Codling Moth.**—*J. econ. Ent.* **36** no. 3 p. 473, 1 ref. Menasha, Wis., 1943.

The results are given of tests by the apple plug method [*cf. R.A.E.*, A **23** 174] of a number of N-substituted p-bromobenzenesulphonamides against newly hatched larvae of *Cydia* (*Carpocapsa*) *pomonella*, L. The most toxic was definitely less so than lead arsenate ; the others showed little or no toxicity.

MCINDOO (N. E.). **Present Status and future Trends of Nicotine as an Insecticide.**—*J. econ. Ent.* **36** no. 3 pp. 473–475, 1 ref. Menasha, Wis., 1943.

The author points out the importance of nicotine in the United States in time of war, since it is obtainable from tobacco grown in the country, and discusses the extent to which it can replace insecticides that are no longer available and the possibility of increasing its production for this purpose. The quantities of nicotine used against about 40 species of insects in the United States in 1941 are shown in a table, and lists are given of insects against which it is ineffective. Its possibilities as a contact poison have been explored fairly thoroughly, but it is suggested that further investigations should be made on the use of fixed nicotines as stomach poisons, and on methods of applying nicotine as a fumigant.

BARNHART (C. S.). **A Pattern of Thrips Feeding recorded.**—*J. econ. Ent.* **36** no. 3 pp. 476–477, 1 fig. Menasha, Wis., 1943.

The author describes the manner in which an adult and a larva of the citrus thrips, *Scirtothrips citri*, Moult., fed on a dried deposit of a super-saturated solution of sucrose, from which he concludes that this species feeds by puncturing only, since no scraping or rasping action was observed.

TRAVIS (G. E.). **Naphthalene Paste.**—*J. econ. Ent.* **36** no. 3 pp. 477–478, 9 refs. Menasha, Wis., 1943.

A method is described of preparing a stable aqueous suspension of naphthalene in paste form that is readily dispersed in water and has been used successfully for an insect spray. A typical formula consists of 25 per cent. chipped naphthalene, at least 0·3 per cent. glue, not more than 0·15 per cent. ammonium sulphate, and 3 per cent. bentonite in 71·55 per cent. water. The glue is added to facilitate the wetting of the naphthalene, enabling it to be suspended in water, the bentonite is used to prevent rapid settling, and flocculation on dilution is averted by the addition of the ammonium sulphate. To control the bacterial growth that may occur in some mixtures, depending on the amount of glue present, sodium benzoate, thymol, phenol or parachlorometacresol may be used ; none of these preservatives has been observed to have any physical effect on the paste.

Fife (L. C.) & Moreno (I.). **Additional Notes on Host Plants of the Pink Bollworm in Texas and Mexico.**—*J. econ. Ent.* **36** no. 3 pp. 478–479, 4 refs. Menasha, Wis., 1943.

The authors discuss additional observations on *Hibiscus esculentus*, *Malva-viscus drummondi* and *Pseudabutilon lozani* as food-plants of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., in the Lower Rio Grande Valley of Texas and Mexico [*cf. R.A.E.*, A **30** 428]. In addition they report that small numbers of larvae were found in pods of *Abutilon trisulcatum* and buds and flowers of *H. syriacus*, but none was observed on many other malvaceous plants, including some that are known to be food-plants elsewhere.

Grayson (J. M.). **Observations on a Lepidopterous Borer in Ash.**—*J. econ. Ent.* **36** no. 3 p. 479, 3 refs. Menasha, Wis., 1943.

In the early autumn of 1941, it was observed that a white ash tree (*Fraxinus americana*) in Virginia had been severely injured by borers and was rapidly dying. Many adults had evidently emerged from the trunk and larger branches, and others that emerged in the late summer of 1942 were identified as *Podosesia syringae*, Harr. Larvae were removed from the tree on 25th November 1941 and at intervals from 21st April 1942 until early in September. They grew very little between November and April, and fed in the bark and cambium and only superficially in the xylem during the season in which the eggs were deposited, but began to penetrate more deeply into the xylem during April and May of the following year ; the burrows finally reached a depth of $\frac{3}{4}$–$1\frac{3}{4}$ ins. in the xylem and averaged about $\frac{3}{4}$ in. in diameter. An opening was made to the outside of the tree before pupation, and the mature pupae were partly protruded just before the emergence of the adult. Borer activity was indicated by the oozing of sap and the accumulation of great quantities of frass round the base of the tree, particularly during May and June. A total of 95 adults emerged from the tree between 24th August and 25th September 1942 and mated soon after emergence, indicating that this Aegeriid has one generation a year. Many of the larvae were killed in their burrows by a fungus, *Beauveria* sp., which was probably favoured by the excessive rainfall of 1942 ; infested larvae were first found in late July and increased in numbers during August.

Larson (N. P.). **The Common Toad as an Enemy of Blister Beetles.**—*J. econ. Ent.* **36** no. 3 p. 480. Menasha, Wis., 1943.

Bufo americanus was abundant in 1942 in irrigated gardens at Fort Thompson, South Dakota, where blister beetles were numerous and injurious to potato and other crops. Examination of the stomach contents of 100 young toads collected in potato fields just before dark on 24th July and 7th August showed that, with the possible exception of Aphids, blister beetles were the most common single item of food ; 65 stomachs contained 157 individuals. Although there were four species of blister beetles in the potato plantings, only the two dominant species, *Macrobasis immaculata*, Say, and *Epicauta maculata*, Say, were found in the stomachs. They also contained numerous other insects, including adults and larvae of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] ; a list is given of the Orders and families identified.

Barber (G. W.). **Partial Replacement of Pyrethrins by Dichloroethyl Ether in Oil for Control of Corn Earworm.**—*J. econ. Ent.* **36** no. 3 p. 481. Menasha, Wis., 1943.

In experiments in Texas in 1942, white oil (viscosity 125–135 secs. Saybolt) containing pyrethrum extract, dichloroethyl ether or both was applied to maize

silks at a dosage of 0·75 cc. per ear with a force oiler [*cf. R.A.E.*, A **30** 267] in April or May, 7–10 days before roasting-ear harvest, for the control of *Heliothis armigera*, Hb. Counts of the percentages of larvae killed and of ears containing no living larvae at harvest time showed that oil containing 0·1 per cent. pyrethrins with 1 per cent. dichloroethyl ether or 0·15 per cent. with 0·5 per cent. was as effective as oil containing either 0·2 per cent. pyrethrins or 2 per cent. dichloroethyl ether alone, and that a combination of 0·1 per cent. pyrethrins and 2 per cent. dichloroethyl ether (which killed 95·8 per cent. of the larvae) was more effective.

Entomology and Zoology.—*55th Rep. S. Carolina Exp. Sta. 1941–42* pp. 62–64. Clemson, S.C., 1943.

F. Sherman & O. L. Cartwright (p. 62) briefly describe an experiment in South Carolina in 1942 on the effect on infestation by the cowpea curculio [*Chalcodermus aeneus*, Boh.] of planting cowpeas on different dates from 1st May to 15th July. The results and similar data obtained in two previous years are shown in a table. In all three years, the numbers of larvae that emerged from 1,000 pods decreased considerably as the date of planting became progressively later, and in 1941 and 1942 was reduced from 447 and 1,706 in plants sown on 1st May to 72 and 241, respectively, in plants sown on 15th July. Of all the weevils recorded in the experiment in 1942, 27·6, 34·3, 26·9, 7·4 and 3·9 per cent. were produced on plants sown on 1st, 16th and 25th May, 8th and 27th June and 15th July, respectively.

Sherman, Cartwright & W. M. Upholt (pp. 62–64) state that a satisfactory technique was developed during the year, by means of which a stock of the tomato fruitworm [*Heliothis armigera*, Hb.] was reared through two generations. Mating and oviposition were obtained by confining pairs of moths in fish-globes with a capacity of 3 U.S. gals. set in sand in soil tables and feeding them on solutions of honey or cane sugar. The larvae were reared individually in small jars placed horizontally and with the openings covered with screen wire. In field tests of maize-meal baits containing phenothiazine, calcium arsenate, Paris green or cryolite, each at concentrations of 1·25, 2·5, 5 and 10 per cent., the best control and highest yields were given by Paris green, with little difference between the concentrations [*cf. R.A.E.*, A **31** 254]. Phenothiazine at all concentrations and Paris green at 10 per cent. scorched the plants, and phenothiazine also caused russetting on the fruit. There was no significant difference in result when fine and coarse maize meal was used in the baits.

Bondy (F. F.) & Rainwater (C. F.). **Cotton Insect Studies.**—*55th Rep. S. Carolina Exp. Sta. 1941–42* pp. 107–113. Clemson, S.C., 1943.

The results of investigations in South Carolina in 1937–42 on substitutes for calcium-arsenate dust for the control of the boll weevil [*Anthonomus grandis*, Boh.] on cotton are given in a table and discussed. The dusts used comprised fixed nicotines, which showed no promise, synthetic cryolites, sodium fluosilicate and barium fluosilicate. Practically all of these were too heavy to give adequate coverage [*cf. R.A.E.*, A **28** 360, 649], and the results varied considerably from year to year. The yield from plots treated with the test materials compared more favourably than the infestation records with the corresponding data from plots dusted with calcium arsenate, since in some years infestation by Aphids [*Aphis gossypii*, Glov.] in the latter was severe ; about as many Aphids appeared on plots dusted with barium fluosilicate, however, as on those receiving calcium arsenate. Both fluosilicates were heavy and tended to pack, but this fault was counteracted to some extent by the addition of a small amount of buffering agent. Both caused some scorching of the foliage, and that due to sodium fluosilicate was severe in 1939, but it was found in 1942 that the addition to it

of 10 per cent. soy-bean flour counteracted this tendency. Over the whole period, treatment with barium fluosilicate and cryolite resulted in 13·27 and 19·58 per cent. punctured squares, as compared with 10·59 for calcium arsenate, and these materials are regarded as showing some promise, provided that their dusting qualities can be improved.

Infestation by *Anthonomus* was sporadic in South Carolina in 1942. A relatively large population survived the winter and 76 per cent. of the weevils had emerged from hibernation by 15th June, the average percentage emergence by this date over a period of four years being 54, but hot dry weather at the end of June and the beginning of July destroyed most of the first-generation larvae, and despite frequent rains later in the season, damage was serious in only a few isolated fields. Experiments on the combined control of the weevil and *Aphis gossypii* in general confirmed previous results [*cf.* **31** 189], and no Aphid injury occurred in any plot dusted with calcium arsenate reinforced by enough ground cubé root to give 0·5 per cent. rotenone or by 1 per cent. nicotine.

Allen (N.) & Pollard (H. N.). **Tobacco Insects.**—*55th Rep. S. Carolina Exp. Sta. 1941–42* pp. 119–128, 6 figs. Clemson, S.C., 1943.

Gnorimoschema operculella, Zell., was sufficiently injurious to tobacco in South Carolina in 1942 to indicate that it may become a major pest of this crop, particularly where potatoes are extensively grown. The larvae cause blister-like areas to form on the small leaves, and these patches later turn brown and dry; small plants may be completely destroyed if infestation is severe. A survey in May in one of the two counties affected showed that 8 of 15 tobacco fields and 6 of 13 potato fields were infested. Six of the infested tobacco fields adjoined infested potato fields or buildings in which potatoes were stored and two had been under potatoes in the previous year; five of the infested potato fields were near infested tobacco or a potato storage. One potato field was not infested, although it adjoined a tobacco field in which *G. operculella* was present. Injury to tobacco was most severe in a field near a curing barn in which potato culls were stored after the 1941 harvest. Soon after the plants were set out, many appeared to be stunted and a high proportion of these died. The plants nearest to the barn were affected most, and this part of the field was replanted three times before 21st May. In July, large numbers of larvae were feeding in potato tubers in open crates and barrels in open storages, and infestation persisted in tobacco fields where larvae had been numerous in May, the lower leaves being attacked. In August, after the tobacco had been harvested, larvae fed on the new shoots sprouting from the stalks. Recommended control measures comprise prompt marketing of potatoes, destruction of infested tubers, avoidance of open storages for potato tubers, prompt cutting and ploughing under of infected tobacco stalks, the avoidance of sites near potato storages and previously infested potato fields for planting tobacco or potato, and the removal and destruction of infested leaves from young tobacco plants.

Heliothis armigera, Hb., caused severe injury to tobacco on two farms, in different counties. The larvae bored in the buds of young plants and fed on the leaves and in the stems of larger ones. It was necessary to cut young infested plants down to ground level and larger ones to a point below the lowest burrow to induce the formation of new shoots. On both farms, the larvae first appeared on vetch, from which they migrated to the tobacco, and most of the injury occurred before their presence was recognised. They also migrated from a field of vetch and oats in another part of one of the farms and attacked tobacco, sweet potato, soy beans, maize, cotton, velvet beans [*Stizolobium*], wheat and, to a less extent, sugar-cane. In all cases the vetch had produced seed-pods, which the larvae destroyed before migrating. In tests of various dusts, sprays and poison baits, a bait of 2 lb. barium fluosilicate or 4 lb. cryolite with 48 lb. maize meal or wheat middlings applied at the rate of about 48 lb.

per acre gave satisfactory control on tobacco, and a spray of 6 lb. basic copper arsenate in 50 U.S. gals. water was effective against larvae feeding on the leaves of other small plants. Many larvae were trapped in holes, 6 ins. deep and 12-14 ft. apart, in deep furrows ploughed round the vetch fields with the steep side of the furrow near the field to be protected. Vetch plants growing near tobacco should be turned under before they produce seed ; if they are infested, this should be done by cutting with a disk harrow, ploughing under, and again disking to leave the surface rough.

TATE (H. D.). **Insects as Vectors of Yellow Dwarf, a Virus Disease of Onions.**—*Iowa St. Coll. J. Sci.* **14** no. 3 pp. 267–294, 16 refs. Ames, Iowa, 1940. [Recd. 1944.]

This thesis is a detailed account of investigations in Iowa in 1931–35 on the insect vectors of yellow dwarf of onion [*Marmor cepae* of Holmes], which have already been noticed [*cf. R.A.E.*, A **21** 605, etc.]. It is concluded that almost all species of Aphids are potential vectors, but the recorded cases of transmission by two other insects [**20** 706] are now regarded as doubtful.

RICHARDSON (C. H.) & ELLISOR (L. O.). **Effect of pH on the Toxicity of Nicotine injected into the Cockroach** *Periplaneta americana* **(L.).**—*Iowa St. Coll. J. Sci.* **14** no. 3 pp. 305–316, 4 graphs, 24 refs. Ames, Iowa, 1940. [Recd. 1944.]

The following is taken from the authors' summary. No significant difference was observed in the mortality from relatively large doses of nicotine injected into *Periplaneta americana*, L., that could be related to the pH of the solutions ; nor did the paralytic and recovery times after injection of sublethal doses vary consistently, throughout the experiments, with the hydrogen-ion concentration. Such differences as did occur did not support the hypothesis that injected nicotine molecules are more active than injected ions.

LINDSAY (D. R.). **The Biology and Morphology of** *Colaspis flavida* **(Say).** (Abstract.)—*Iowa St. Coll. J. Sci.* **18** no. 1 pp. 60–61. Ames, Iowa, 1943.

A recent outbreak of the Eumolpid, *Colaspis flavida*, Say, as a pest of maize in eastern and east central Iowa is discussed. Oviposition is at its height in July–August. The females lay about 150 eggs, usually in two batches, and the larvae hatch in 1–2 weeks and develop to about the sixth instar before frost sets in. Winter is passed at a depth of about 10 ins. in the soil. Development continues in the spring and severe injury may be done to maize planted on land that has been under red clover. In the breeding experiments, there were 10–17 larval instars, but it is thought that 10 is the normal number. Pupation lasts about 1 week, and adults, which survive for 3–4 weeks, emerge from late June to early August. The sexes are about equal in numbers. The adults were observed to feed readily on smartweed (*Polygonum lapathifolium*), which is common in maize fields in eastern Iowa.

SHELFORD (V. E.) & FLINT (W. P.). **Populations of the Chinch Bug in the Upper Mississippi Valley from 1823 to 1940.**—*Ecology* **24** no. 4 pp. 435–455, 9 figs., 46 refs. Lancaster, Pa., 1943.

In this paper, the authors review the original and cultivated food-plants of *Blissus leucopterus*, Say, in the upper Mississippi valley and the populations on cultivated cereals, discuss the relation of population density to weather and the

various recorded outbreaks that have occurred in the area, and give maps showing the areas in which serious and slight damage was caused in each of the years 1840–1940.

The following is substantially their summary. Populations of *B. leucopterus* vary in midsummer from very few (or even none in certain localities) to 70 million per acre in others. To make proper correlations with the broader aspects of meteorological conditions, closely placed observation stations are necessary so that the average condition over a large territory can be arrived at. Records from 1820 to 1940 on an area of 120,000 sq. miles with its centre near the centre of Illinois are presented. There is correlation with sun-spot numbers, but the use of average time between sun-spot maxima and population maxima is rejected as meaningless because of the variation in both. During one period in which both are available, the correlation of population with ultra-violet intensity is closer than with sun-spot numbers. Within the area of study the correlation of much, or little, May or June rainfall with few, or many, insects is good. But when rainfall in either month is high, a very large overwintering population is probably necessary to provide a chance for a population to pass or fail to reach the critical early nymphal periods at the time the heavy rains come. Rainfall considerably below normal in August–October often gives rise to a large overwintering population following a small one. If the spring months are favourable, a population sufficiently large to cause crop damage may arise. Populations sufficient to cause damage to cereals or other cultivated grasses are associated with growing seasons (March–October) in which temperatures are above normal, and rainfall below normal. The monthly summation and averaging period of weather bureaux is 2–4 times too long for good biological use of weather data. Spottiness of rainfall indicates that weather stations in the area of study are about 20 times too far apart to provide data for such study. There is an unexplained difference in the vigour of the bugs on emerging from hibernation in different years. No explanation of the rises of populations is complete or perfect, but on the whole, correlation with weather conditions is very good.

VERGANI (A. R.). *Anychus verganii*, **nuevo ácaro dañino para los citrus.** [A new Mite, *A. verganii*, infesting *Citrus*.]—*Rev. argent. Agron.* **8** no. 4 pp. 380–382, 2 pls., 18 refs. Buenos Aires, 1941.

This paper, of which an abridged version has already been noticed [*R.A.E.*, A **31** 476], includes descriptions of the adults and egg of the mite, *Anychus verganii*, Blanch., on *Citrus* in Corrientes, Argentina. Treatments that gave complete control included a dust of sulphur with the addition of 20 per cent. slaked lime and sprays of 1 per cent. wettable sulphur, 2 per cent. white oil emulsion and 1 per cent. lime-sulphur.

HUNT (G. M.) & SNYDER (T. E.). **An international Termite Exposure Test.—Fourteenth Progress Report.**—[*Proc.*] *Amer. Wood Pres. Ass.* [**39**] preprint 16 pp. [Baltimore, Md.] 1943.

Data are tabulated on the condition of the original specimens of wood treated with various preservatives after 14 years' exposure to termites and decay in four countries [*cf. R.A.E.*, A **31** 524] and of subsequent series of specimens installed in the Panama Canal Zone in 1931, 1933, 1938, 1940 and 1941.

BREDO (H. J.). **La lutte contre les sauterelles migratrices dans leurs aires grégarigènes.**—*Servir* 1943 repr. 14 pp. Astrida, Ruanda, 1943.

This is a review of data on the phases of migratory locusts, the way in which their occurrence between outbreaks is restricted to special breeding areas,

from which they migrate when a change of conditions causes them to assume the gregarious phase, and the possibility of preventing outbreaks by keeping the breeding areas under supervision and control by international organisation, with particular reference to *Nomadacris septemfasciata*, Serv., and *Locusta migratoria migratorioides*, R. & F., the species of importance in the Belgian Congo.

Le Pelley (R. H.). **An Oriental Mealybug** (*Pseudococcus lilacinus* **Ckll.**) (**Hemiptera**) **and its Insect Enemies.**—*Trans. R. ent. Soc. Lond.* **93** pt. 1 pp. 73–93, 4 pls., 7 figs., 46 refs. London, 1943.

The greater part of this paper comprises notes on insect parasites and predators of *Pseudococcus lilacinus*, Ckll., collected in 1936–37 in the Philippines, the Netherlands Indies, Ceylon and southern India in an attempt to discover species suitable for introduction into Kenya Colony against *P. kenyae*, Le Pelley, on coffee [*R.A.E.*, A **27** 665]. The synonymy of *P. lilacinus* (*crotonis*, Green, *tayabanus*, Ckll.) is discussed, and reasons are given for disagreeing with Betrem's views [**26** 608] and for regarding *P. kenyae* as distinct from it. In addition to the countries surveyed, it also occurs in Malaya, where it is rare, and Formosa, and is restricted to altitudes up to approximately 3,000 ft., whereas *P. kenyae* occurs only in parts of Uganda and a small lake shore area in Tanganyika Territory, where it appears to be indigenous and supports many parasites, and the part of Kenya into which it has been introduced. It normally exists at high altitudes. The chief food-plants of *P. lilacinus* include *Annona muricata*, guava, cacao, *Ceiba pentandra* and species of *Bauhinia*, *Spondias* and *Erythrina*. It is not often found on *Citrus*, and coffee usually grows above its altitude range, though it has been recorded on it in Formosa. A list is given of 13 new food-plants in the Philippines and 3 in southern India. The mealybug is attended by many ants, and notes are given on the distribution and frequency of the various species observed.

P. lilacinus was locally abundant at Los Baños in the Philippines, where its most important predators were the Lycaenid, *Spalgis epius*, Westw., and the Coccinellid, *Platynaspis stictica*, Crotch, subsp. *philippensis*, Korchefsky. The latter was always present, sometimes in large numbers, in collections from guava. Other Coccinellids that attacked the mealybug comprised a species tentatively identified as *Scymnus* (*Nephus*) *oblongosignatus*, Muls., which was common in one collection from guava and was parasitised by *Homalotylus* sp., and *Aspidimerus tristis*, Weise, and an unidentified species of *Scymnus*, which were not abundant. *Coccodiplosis pseudococci*, de Meij., appeared to be an important predator, but the larvae in the cocoons were at times heavily parasitised by a species of *Ceraphron* (*Calliceras*). As many as six larvae of this Cecidomyiid attacked a single adult of *P. lilacinus*, and evidence was obtained that the mealybug is killed by the attack. Larvae of an unidentified predacious Cecidomyiid were also common. Eleven Encyrtid parasites were associated with *P. lilacinus*, of which at least three, including a species of *Achrysopophagus*, are probably hyperparasites. Only three of the others were of any importance, and the chief of these was *Pseudaphycus orientalis*, Ferrière. Up to 30 adults of this species emerged from a single host. Development from oviposition to adult emergence lasted 19–21 days at a mean temperature of about 75°F. Pairing and oviposition occurred soon after emergence, and adults fed on honey survived in the laboratory for about 16 days. This parasite practically eliminated the mealybug on heavily-infested small trees of *Bauhinia monandra* in little over a month, but was not found in numbers on plants other than *Bauhinia*. *Anagyrus lilacini*, Ferrière, occurred in most collections of the mealybug from various food-plants, and, though never very numerous, appeared to be of some value, even where *P. orientalis* was dominant. Development lasted 20–24 days at about 75°F., and adults fed on honey survived for up to

30 days. *Taftia saissetiae*, Gah., was common and is thought to be a primary parasite. Others included *Aphycus* sp. and another species of *Anagyrus*, both obtained in small numbers.

P. lilacinus is common in the Netherlands Indies. Its chief predators there are *Spalgis epius*, *Scymnus apiciflavus*, Motsch., which is parasitised by *Homalotylus* sp., and *Coccodiplosis pseudococci*, which is parasitised by a species of *Ceraphron*, apparently the same as that found in the Philippines, and it is also attacked by another Cecidomyiid and a species of *Eublemma*. The most important parasites are *Anagyrus* spp. and a species of *Taftia* that also attacked *P. lepelleyi*, Betrem. Of the species of *Anagyrus*, the most important in Java is probably identical with the undetermined Philippine species. It appears to be capable of completely destroying infestations of *P. lilacinus*.

In Ceylon, *P. lilacinus* is common on *Annona muricata* and cacao but is less abundant than in Java. *Spalgis epius* was fairly common, and other predators comprised four Coccinellids, none of which is of importance, and a Cecidomyiid, probably *Coccodiplosis pseudococci*, that was attacked by a parasite similar to the Philippine *Ceraphron*. A species of *Anagyrus* and another fairly common Encyrtid parasitised the mealybug.

In southern India, *P. lilacinus* was common only at Coimbatore, but was collected at four other localities from which it had not previously been recorded. Its natural enemies comprised *S. epius* and three Coccinellids, including *Hyperaspis maindroni*, Sic., and a species tentatively determined as *Scymnus* (*Nephus*) *severini*, Weise, which were of some importance, *Eublemma* sp., *Leucopis luteicornis*, Malloch, two other Cecidomyiids, a species of *Anagyrus*, and another Encyrtid, possibly *Tetracnemus indicus*, Ram. Ayyar, which was common.

Information on the abundance of the various species in the different localities is summarised in a table.

Swan (D. C.). **Notes on the Lesser Grain Borer** (*Rhizopertha dominica* **Fabr.**) **in South Australia.**—*J. Dep. Agric. S. Aust.* **45** pp. 45-52, 8 figs., 1 graph, 3 refs. Adelaide, 1941.

Rhizopertha dominica, F., caused much damage to stored wheat in South Australia in 1916–20 [*cf. R.A.E.*, A **30** 278] but was not observed there for 20 years after the accumulated stocks of grain had been dispersed. In early April 1941, however, this Bostrychid was found to be well established in wheat stored in bags at Port Pirie, and early in June a slight infestation was discovered in a stack at Kadina. In both cases the wheat had been harvested at the end of 1939. An inspection at Port Pirie in September 1940 had shown the wheat to be free from *Calandra* spp. and *Rhizopertha*. It is suggested that the latter may have survived there since 1920 in small numbers in the wharves, which were regularly used for the shipment of wheat, and that it had been favoured by the resumption of long-term storage, which had enabled it to breed in the same wheat for two successive summers. The fact that Port Pirie has a long hot summer, during which the temperature exceeds 80°F. for 5½ months, may account for its more rapid multiplication in this place than elsewhere. The infestations were restricted to groups of a few heavily infested bags on the faces of the stacks, and occasional insects were seen in spilt wheat at the foot of stacks about half a mile from the main centres of infestation. The stack at Kadina was situated on ground on which wheat had not been stacked since 1920, and was about half a mile from the railway station, the nearest possible source of infestation. The infested bags were all burnt and the stack section cleared, the site, dunnage and roofing sprayed with an oil emulsion and the floor flamed over, but infestation was again observed in the stack in August. The author has been informed by R. N. McCulloch that bags infested by *Rhizopertha* were also found in a stack at Sydney, New South Wales. The temperature in one patch

ranged from 61 to 98°F., and moderate infestation occurred in bags in which the temperature was 70–80°F. The temperature in neighbouring uninfested bags was 61°F. and the moisture content 9·4–10·7 per cent. It is considered in this case that some of the bags were already infested when placed in the stack.

The damage caused by the borer to wheat in bags is described and compared with that caused by *Calandra* spp., which were uncommon at Port Pirie. The large quantities of frass in the form of a fine white floury powder produced by *R. dominica* offer favourable conditions for the breeding of a number of secondary insect pests, of which *Tribolium castaneum*, Hbst., and *Laemophloeus ferrugineus*, Steph., were both present at Port Pirie. *R. dominica* is a serious pest because it possesses a high reproductive capacity, feeds voraciously, can attack grain that is too dry for *Calandra*, and readily spreads in warm weather throughout a wheat-storage area. Since it flies into railway trucks or motor vehicles standing near the infested stacks, it may thus be easily transported to uninfested areas, and every precaution should be taken to avoid this.

Insect Pests.—*Agric. Gaz. N.S.W.* **54** pts. 5–7 pp. 227–230, 241, 275–279, 313–317, 19 figs. Sydney, 1943.

The first of these parts of a series on insects and mites in New South Wales [*cf. R.A.E.*, A **31** 525] includes notes on the bionomics of *Sitotroga cerealella*, Ol., and its control in stored grain. To prevent infestation, the crop should be harvested promptly and stored in silos if possible or in bags in stacks or barns; all waste grain from the previous season should be destroyed and the walls of barns should be swept and, as an additional precaution, sprayed with a strong kerosene emulsion containing 3 per cent. cresylic acid. Keeping the moisture content of the grain at 13 per cent. or less greatly reduces damage. Infested grain should be heated to 120 or 125°F. for several hours or fumigated with hydrocyanic acid gas or carbon bisulphide; the latter should be poured on to sacks on top of the grain at the rate of 5 lb. per 1,000 cu. ft. air space in a silo or shed that is reasonably gas-tight or at up to 20 lb. per 1,000 cu. ft. under other conditions, and the fumigation period should be 24 hours if the grain is to be used for seed or longer if it is not.

The second part comprises a description of the life-history and control of the native weevil, *Baryopadus* (*Leptops*) *squalidus*, Boh., and the damage it causes to *Citrus* and deciduous fruit trees in the coastal districts and southern tablelands of New South Wales, where it is a serious pest [*cf.* **24** 446], notes on the biology and appearance of several Coccinellids, chiefly species that prey on Aphids and Coccids, and a very brief account of the life-history and control of *Lecanium persicae*, F., on grape vines [*cf.* **22** 622]. The third part contains information on the damage caused to vines by the mites, *Eriophyes vitis*, Land., which is not usually a serious pest, *Tenuipalpus californicus*, Banks, which may cause severe injury to the grapes and *Phyllocoptes* sp., which is probably not of any great economic importance, and their control [*cf.* **22** 622].

Wilson (F.) & Campbell (T. G.). **Recent Progress in the entomological Control of St. John's Wort.**—*J. Coun. sci. industr. Res. Aust.* **16** no. 2 pp. 45–56, 3 figs., 2 refs. Melbourne, 1943.

Much of the information in this report on the introduction from England and France and establishment in Australia of insects that attack the noxious weed, *Hypericum perforatum*, has been noticed from shorter accounts [*R.A.E.*, A **20** 612; **27** 282; **29** 143; **30** 101; **31** 45]. *Chrysomela* (*Chrysolina*) *hyperici*, Forst., which was liberated in Victoria in 1934 and found to be well established there in November 1939 [**30** 101], has since spread for a distance of 8 miles and increased to such an extent that adults for liberation in other districts have been

collected there each year. Details of 24 releases at various sites in Victoria and New South Wales between December 1939 and December 1941 are given in a table. The beetle has become established at 18 of them, including some in each State. The great delay in initial multiplication appears to have been partly due to the infertility of the individuals first liberated ; they were difficult to rear in the laboratory and laid few eggs, many of which were not fertile. By 1942, population densities exceeded those observed in England or France. Dispersal is to some extent by flight, which was not observed in the field in England, though it occurred occasionally in the laboratory at fairly high temperatures, since in some cases intervening stands of *Hypericum* have been passed over. Some small areas have been completely cleared of the weed. The beetles spread chiefly along the valleys and are unlikely to attack stands on hill-sides until they are forced by shortage of food to migrate uphill.

Aestivating adults of *Chrysomela* (*Chrysolina*) *gemellata*, Geoffr., were shipped from France by air in July 1939 and liberated in Victoria in August and October, and there was little time for them to leave aestivation, feed, mate and oviposit before the end of the oviposition season (autumn to spring). They were thought to have died out [**31** 45], but recoveries were made in October 1942, and by early December as many as 4,000 adults were collected from a field in which they were particularly abundant and liberated in New South Wales. The beetle is not yet sufficiently numerous at the original point of liberation to cause any marked effect on *Hypericum*, but its progress is considered satisfactory in view of the unfavourable circumstances under which it was liberated. It flies readily in Victoria, though it was not observed to do so in Europe except at high temperatures in the laboratory.

Agrilus hyperici, Crtz., has only one generation a year, but is established at each of the places (four in Victoria and three in New South Wales) in which it was liberated in 1939 or 1940 [*cf.* **31** 45]. It has killed some plants, and it is known that the growth of infested plants is restricted.

Hibernating pupae of *Actinotia hyperici*, Schiff., were shipped from France by air in 1939 and 1940, and reached Canberra in good condition, but the stocks of this Noctuid were destroyed without release, since its reproduction rate is not great and it might attack alternative food-plants.

In a discussion of future prospects, it is thought likely that *C. hyperici* and *Agrilus hyperici* will eventually become established throughout the area covered by *Hypericum*, since they are now present in some of the coolest and some of the warmest parts of it. *C. gemellata* is at present established only in a cool area, but its distribution and that of *C. hyperici* in France indicate that it will be more successful than the latter in warm districts. The ease with which *A. hyperici* was established is attributed to the inaccessibility to parasites and predators of the immature stages in the roots and the absence of its specific parasite, an undescribed species of *Dinarmus*. This Buprestid is likely to be even more effective in Australia than in France, where areas of *Hypericum* are at times eliminated by it. *C. hyperici* is likely to give effective control in cool areas, since although its progress is hindered by predators, its reproductive rate is high and several parasites that attack it in Europe are absent in Australia. Adults of *C. gemellata* are attacked by scorpion flies [Mecoptera] and spiders and the larvae probably by ants, but these are not likely to hinder its establishment.

HILL (A. V.). **Insect Transmission and Host Plants of Virescence (Big Bud of Tomato).**—*J. Coun. sci. industr. Res. Aust.* **16** no. 2 pp. 85–90, 2 pls., 9 refs. Melbourne, 1943.

The virus disease known as big bud of tomato [*Galla australiensis* of Holmes] occurs in Australia and the north-western United States, and a disease known

as virescence or greening, which Ryjkoff considered to be identical with it, occurs in tomato, tobacco and other solanaceous plants in the Russian Union. The author also thinks that a single virus is concerned and prefers the name virescence for the disease, as it does not always cause the enlargement of the calyx that led to its being called big bud. The same or a closely related disease has been recorded in egg-plant (*Solanum melongena*) in southern India, where it is transmitted by two Jassids [*R.A.E.*, A **29** 542]. Virescence is common in plants in Australia, and a list is given of some 70 species in 24 families that have been observed to be naturally infected with it. They include tomato, tobacco, egg-plant, clovers, lettuce, beet, parsley, carrot, celery and parsnip. Its seasonal occurrence in various plants is briefly discussed, and it is recorded that it was transmissible in certain cases by grafting.

Insects collected from fields containing affected plants comprised *Nezara viridula*, L., *Thrips tabaci*, Lind., *Nysius vinitor*, Bergr., *Empoasca terrae-reginae*, Paoli, *Eurinoscopus viridis*, Evans, *Erythroneura* spp. and *Thamnotettix argentata*, Evans, but only the last was found to transmit the disease. It did so to 23 species of plants, including tobacco, tomato, egg-plant, *Capsicum annuum*, clovers and sugar-beet, and both nymphs and adults were shown to be vectors. Proliferation of the flower parts and the development in them of green coloration occurred in all except sugar-beet, infected seedlings of which gave rise to large numbers of small leaves and died without producing an inflorescence. The symptoms appeared in 24–155 days, according to the period between the dates of infection and flowering and the season of the year. One or more healthy flowers were usually produced before the symptoms appeared, the axillary buds frequently gave rise to short branches with numerous small leaves with short petioles, and the floral axis continued to elongate.

Most of the plants on which the Jassids feed in summer [*cf.* **31** 137] are susceptible to virescence, though not suitable for breeding, but in irrigated districts and in seasons in which summer rainfall is high, plants on which they breed may be available at that time. The disease was difficult to transmit from solanaceous plants, since they are not preferred food or breeding plants, but it is readily transmitted to them from plants of other natural orders. The Jassids are thought to become infected from diseased biennials or perennials during migration and subsequently to transmit the virus to annuals. Infection apparently occurs only during the warmer months of the year ; if it occurs in cool weather, the symptoms are masked, but their absence in spring and autumn breeding plants indicates that these are not infected, since the disease should in that case appear earlier and in a higher proportion of susceptible plants.

GRAY (S. G.). **Fasciation in Cabbage.**—*J. Coun. sci. industr. Res. Aust.* **16** no. 2 p. 92, 1 pl. Melbourne, 1943.

A batch of cabbage plants set out in the field at Canberra in November 1941, after various experimental exposures to low temperatures, made little progress after reaching the stage of seed stalk formation in February 1942 and produced large numbers of lateral buds during March. Growth was resumed in August, and early in September it was noticed that some of the developing flower stalks were flattened in form. Almost all the plants developed abnormally during the next few weeks, some having an unusual number of branches, some strap-shaped main stems and some main stems that were short, flattened and fan-shaped. These malformations are considered to have been due to traumatic influence resulting from injury to the growing points by *Brevicoryne brassicae*, L., which infested the plants during the early stages of growth. Seed was set normally, however, and the yield was 263 lb. per acre, as compared with a normal yield of about 300 lb. seed per acre.

Helson (G. A. H.) & Powning (R. F.). **Two promising Insecticides.**—*J. Coun. Sci. industr. Res. Aust.* **16** no. 2 pp. 107–108. Melbourne, 1943.

Notes are given on two insecticides on which work is in progress in Australia, one of which, known as Paranaph, can be used as a substitute for nicotine sulphate. This material was developed in 1895 and was in use against various insects, notably Aphids, for about 20 years. To prepare it, 56 lb. fresh soft soap and 6 lb. whizzed or flake naphthalene are successively stirred into 2 gals. water simmering over a fire until they are dissolved, the solution is removed from the fire and 2 gals. kerosene mixed with it. The mixture, which should be semi-solid and uniform, is used at the rate of 1½–2 gals. per 100 gals. water. Tests showed that this spray gives excellent control of *Brevicoryne brassicae*, L., on cabbage, but is slightly less effective than nicotine sulphate against other Aphids. It is toxic at temperatures as low as 48°F., however, and can therefore be used during the cooler parts of the year, when nicotine sulphate is ineffective. It is not toxic to predacious Syrphid larvae, and has good wetting properties.

In an attempt to discover an Australian substitute for the kerosene in this formula, it was found that a tar distillate (spraying creosote) with a boiling range of 250–350°C., which is toxic and repellent to Aphids, but injurious to plants, could be used for this purpose. In the field, the mixture at concentrations of up to 2 per cent. did not injure the foliage of apricot, peach, swede, silver beet and mustard, or the fruit of apricot and peach, and did not prevent the flowering heads of carrots, which it discoloured, from setting seed. Potato and tomato foliage sprayed with a concentration of ½ per cent. became discoloured after a day or two, and there was some injury to tomato flowers. A concentration of 2 per cent. gave complete mortality of the adults of *Nysius vinitor*, Bergr., and destroyed the youngest stages of *Nezara viridula*, L. A single application to the flowering heads of carrot reduced populations of *Nysius vinitor* to 20 per cent. and maintained them at this level for a fortnight.

Ext (W.). **Kornkäferbekämpfung einst und jetzt.** [Past and present Control of the Grain Weevil.]—*Z. PflKrankh.* **53** pt. 4–7 pp. 161–172, 56 refs. Stuttgart, 1943.

The author contrasts the methods available against the grain weevil [*Calandra granaria*, L.] in Germany in 1923 with those now employed. It is no longer necessary to use the highly explosive carbon bisulphide, as either Cartox (a mixture of ethylene oxide and carbon dioxide [1 : 9]) or Areginal, which was evolved as a result of the discovery that ethyl and methyl formate are effective fumigants, kills all stages of *C. granaria* in silos, while Delicia, a preparation that releases hydrogen phosphide when in contact with the moisture in grain, is effective in store rooms. The use of quartz dusts was prohibited early in 1941 on account of the danger of silicosis [*cf. R.A.E.*, A **31** 381].

Pape (H.). **Ein Wickler als Gloxinienschädling.** [A Tortricid Pest of Gloxinias.] —*Z. PflKrankh.* **53** pt. 4–7 pp. 173–175, 3 figs. Stuttgart, 1943.

Larvae of *Cnephasia wahlbomiana*, L., destroyed the young leaves and flower buds and mined the stems of the older leaves of gloxinias in southern Germany in 1941 and 1942. It is thought that oviposition could be reduced and the newly hatched larvae killed by dusting the shoots with tobacco dust or spraying them with nicotine.

Campisi (C.). **Un nuovo metodo di lotta contro il *Phloeotribus scarabaeoides* Bern.-Fauy.** [A new Measure against *P. scarabaeoides*.]—24 pp. Bari, Canfora & C., 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 250. Stuttgart, 1943.)

A trap found effective for adults of *Phloeotribus scarabaeoides*, Bern., in Italy consists of a white enamelled basin about 12 ins. in diameter, which is suspended

by wires at a height of 16–19 ft. in a group of four olive trees and kept filled with clean water. The beetles are attracted by the shining surface and are drowned.

Sartory (A.) & Meyer (J.). **Une bactérie cellulosolytique,** *Clostridium leptinotarsae* **n. sp., isolée du tube digestif du doryphore et son influence sur l'évolution de l'insecte.**—*C. R. Acad. Sci.* **212** pp. 817–819. Paris, 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 250. Stuttgart, 1943.)

The authors describe the morphological and biochemical characters of a new anaerobic bacterium from the digestive tract of the potato beetle [*Leptinotarsa decemlineata*, Say], but, despite the title, do not deal with its influence on the development of the beetle.

Wilcke (J.). **Biologie en morphologie van** *Psylla buxi*.—*Tijdschr. PlZiekt.* **47** pp. 41–89, 35 figs. 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 251. Stuttgart, 1943.)

Psylla buxi, L., has only one generation a year in Holland. The eggs are laid from July onwards on the outer scales of the dormant buds of box (*Buxus*) and the first-instar nymphs hibernate, the first moult occurring early in April. The adults are present from the end of May until September. The structure and development of the eggs, the development of the nymphs and the abdominal segments of the adults are described in detail. Spraying in winter with 5–7·5 per cent. tar distillate has given good control.

Kronenberg (H. G.). *Phyllobius urticae* **de Geer schadelijk aan aardbeien in Kennemerland.** [*P. urticae* injurious to Strawberry in Kennemerland.]—*Tijdschr. PlZiekt.* **47** pp. 186–193. 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 257. Stuttgart, 1943.)

Phyllobius urticae, Deg., is a serious pest of strawberry in the Kennemerland district of Holland ; the larvae attack the roots and sometimes kill all the plants in a field. The adults feed on the edges of the leaves and also infest stinging nettles [*Urtica*], which should be destroyed near strawberries.

Bos (J.). **De wormstekigheid bij appel in Nederland.** [Worminess in Apples in Holland.]—*Tijdschr. PlZiekt.* **48** pp. 73–85. 1942. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 230. Stuttgart, 1943.)

Notes are given on the seasonal history of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in Holland in 1940 and 1941, based on material bred from trap-bands. There was a partial second generation in each year, and about 1 per cent. of the larvae were parasitised by *Pristomerus vulnerator*, Panz. More larvae were taken in trap-bands placed at a height of 20 ins. than in those at 50–60 ins. The formation of cocoons began before 10th July, so that the bands are usually placed on the trees too late.

Wolters (H. J.). **Achtet auf den Flachsblasenfuss ! Erfahrungen mit der Bekämpfung in Holland.** [Take Notice of the Flax Thrips. Experiences in Control in Holland.]—*Dtsch. landw. Pr.* **69** p. 202. 1942. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 255. Stuttgart, 1943.)

The best control of *Thrips lini*, Lad. (*linarius*, Uzel) and *T. angusticeps*, Uzel, on flax in Holland has been given by dusting with derris powder containing 1 per cent. rotenone at the rate of 36 lb. per acre while the plants are wet with dew.

Larsson (S. G.). **Bedelusen, *Aphis fabae* Scop., og dens Vaertplanter, specielt der danske Forholt.** [*A. fabae* and its Food-plants in Denmark.]—*Tidsskr. Planteavl* **46** pp. 298–323. 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 pp. 251–252. Stuttgart, 1943.)

In Denmark, *Aphis fabae*, Scop., overwinters chiefly on *Euonymus europaeus*, but also on other species of *Euonymus* and on *Viburnum* and *Philadelphus*. A list of its summer food-plants, based on observations near Copenhagen in 1939–40, includes 79 new records.

Vappula (N. A.). **Zwei *Dasyneura*-Arten als Schädlinge der schwarzen Johannisbeere.** [Two Species of *Dasyneura* as Pests of Black Currant.]—*Ann. ent. fenn.* **7** pp. 112–117. 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 246. Stuttgart, 1943.)

Dasyneura ribis, Barnes, which produces flower galls on black currant, has been recorded only from Finland [*R.A.E.*, A **28** 534], where it sometimes becomes of economic importance. The larvae of *D. tetensi*, Rübs., infest black currants in Finland, Britain and Germany. They feed on the upper surface of the young leaves, causing them to crinkle, and pupate in the soil. This Cecidomyiid has probably at least three generations a year in Finland and can be controlled by the removal of infested shoots or dipping in a nicotine bath.

Saalas (U.). ***Aleurodes proletella* L. (Hem., Aleurodidae) in Finnland gefunden.** [*In Finnish.*] [*A. proletella* found in Finland.]—*Ann. ent. fenn.* **8** pp. 181–182. 1942. (With a Summary in German.) (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 253. Stuttgart, 1943.)

In October 1941, pupae and adults of *Aleurodes proletella*, L., were found on leaves of *Lactuca muralis* in Finland, where this Aleurodid had not previously been recorded.

Saalas (U.). **Alppiruusujauhiaisen (*Dialeurodes chittendeni* Laing) (Hem., Aleurodidae) esiintyminen Suomessa.** [The Occurrence of *D. chittendeni* in Finland.]—*Ann. ent. fenn.* **8** pp. 182–183. 1942. (Abstr. in *Z. Pfl-Krankh.* **53** pt. 4–7 p. 251. Stuttgart, 1943.)

Dialeurodes chittendeni, Laing, which was known only from England, Canada and the United States, has been found in Finland on rhododendron plants imported from Germany and Holland, and in 1937, it was observed in Sweden on rhododendrons from England.

Daxer (H.). **Ueber die Abhängigkeit der Spritzmittelschäden von Temperatur und Jahresablauf.** [The Dependence of Scorching by Sprays on Temperature and Season.]—*Anz. Schädlingsk.* **17** pp. 13–20, 26–35. 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 pp. 270–271. Stuttgart, 1943.)

In discussing the effect of climatic and physiological factors on spray injury to plants, the author differentiates between the direct and indirect effect of temperature on scorching. The direct effect occurs when a solution of the sprayed material is present on the plant, while the indirect one acts throughout the development of the plant. When dwarf french beans were sprayed with copper sulphate solutions, the least injury occurred at 8–15°C. [46·4–59°F.]. Injury increased with a rise in temperature, but was severe at 2–3°C. [35·6 37·4°F.], sometimes more so than that at 30°C. [86°F.]. Corresponding results were obtained with calcium arsenate. Light did not affect the degree of scorching. Experiments at a constant temperature and in the field with

various fruit trees showed that young leaves and old leaves are more sensitive to injury than others. Heavy rain before spraying, especially in mid-summer or early autumn, increased sensitivity, possibly by washing the leaves.

MÜLLER (H.). **Die Douglasienwollaus** *Gilletteella cooleyi* **Gill. und ihre Bekämpfung.** [The Douglas Fir Woolly Aphis, *Chermes cooleyi*, and its Control.]—*Anz. Schädlingsk.* **17** pp. 121–125, 8 figs. 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 248. Stuttgart, 1943.)

Chermes (*Gilletteëlla*) *cooleyi*, Gill., was introduced into Germany on nursery plants of Douglas fir [*Pseudotsuga taxifolia*] from Scotland [*cf. R.A.E.*, A **23** 524] after the cold winter of 1928–29, and is now widely distributed there [**28** 41, 73], though it was checked to some extent by the severe winter of 1939–40. The regular holocyclic sequence of generations [*cf.* **24** 791, etc.] has now been proved to occur in Germany, with a gall-producing fundatrix and its progeny on certain species of spruce, and hiemales, aestivales and winged sexuparae on Douglas fir. Sprays, including one containing nicotine, alcohol and soap, proved effective in May and June. The regular production of sexual forms requires the destruction of the sexuparae by spraying in May and the removal of the galls on spruce.

KAUFMANN (O.). **Die Bekämpfung des Rübenaaskäfers** (*Blitophaga opaca* **L.**) **mit Derris.** [The Control of *Silpha opaca* by Derris.]—*Anz. Schädlingsk.* **18** pp. 53–56. 1942. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 252. Stuttgart, 1943.)

A proprietary derris dust (Kümex [*cf. R.A.E.*, A **30** 539, etc.]) gave good results against *Silpha* (*Blitophaga*) *opaca*, L., on fodder beet in Schleswig Holstein in 1941, one application at the rate of 18 lb. per acre killing 83 per cent. of the larvae.

REIMANN (W.). **Eine bedeutsame Pflanzenschutzmassnahme im Erdbeeranbau. Der Erdbeerblüten- und Stengelstecher.** [An important Control Measure in Strawberry Cultivation. The Strawberry Blossom Weevil and Stalk Weevil.]—*Geisenheim. Mitt. Obst. u. Gartenb.* **56** pp. 113–114, 121–122. 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 249. Stuttgart, 1943.)

In the Main-Taunus district of Germany, strawberry plants covering about 430 acres are severely attacked by *Anthonomus rubi*, Hbst., and *Rhynchites germanicus*, Hbst. These weevils are best controlled by dusting with derris or a mixture of derris and pyrethrum at the rate of 27 lb. per acre during the time of maturation feeding in late spring.

MADEL (W.). **Bemerkenswerte Schädlingsmeldungen I–III.** [Noteworthy Reports of Pests.]—*Z. hyg. Zool.* **32** pp. 170–175, 3 figs. 1940; **33** pp. 83–90, 5 figs., pp. 157–162, 3 figs. 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 244. Stuttgart, 1943.)

The pests recorded include *Criocephalus rusticus*, L., *Ernobius mollis*, L., and *Xestobium rufovillosum*, Deg., attacking timber in houses in Germany. The Malachiids, *Anthocomus bipunctatus*, Harrer, and *A. fasciatus*, L., are predacious on timber pests.

JANCKE (O.). **Zur diesjährigen Springwurmbekämpfung in der Pfalz.** [Measures taken in 1941 against *Sparganothis pilleriana* in the Palatinate.] —*Dtsch. Weinbau* **20** pp. 633–634. 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 p. 254. Stuttgart, 1943.)

Injury to grape vines by *Sparganothis pilleriana*, Schiff., has increased considerably of recent years in several parts of Germany. The larvae leave their

winter refuges suddenly and spin together the unopened leaves at the tip of the shoots, so that sprays are not very effective, but spraying in winter with Selinon, a preparation containing dinitrocresol, has proved of considerable value. In the spring of 1941, about 2,900 acres of vines were treated, and infestation was usually reduced by over 90 per cent.

SACHTLEBEN (H.). **Beiträge zur Kenntnis der *Diprion*-Parasiten. 1. Einleitung und Bemerkungen über einige *Diprion*-Tachinen.** [Contributions to the Knowledge of the Parasites of *Diprion*. 1. Introduction and Remarks on some Tachinids from *Diprion*.]—*Arb. physiol. angew. Ent.* **9** pp. 89–107. 1942.

OTTEN (E.). **2. Chalcididen als *Diprion*-Parasiten.** [Chalcidoids as Parasites of *Diprion*.]—*T.c.* pp. 108–126. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 pp. 255, 256. Stuttgart, 1943.)

Sachtleben discusses the taxonomy of *Ceromasia inclusa*, Htg., *Diplostichus janithrix*, Htg., *Sturmia inconspicua*, Mg., and *S. gilva*, Htg., bred from *Diprion pini*, L., and allied sawflies and gives a key to them.

Otten gives taxonomic and biological information on Chalcidoids bred in central Europe from *Diprion pini*, L., and related species. The parasites dealt with in this first part of his paper are *Microplectron fuscipenne*, Zett., *Amblymerus subfumatus*, Ratz., *Tritneptis klugi*, Ratz., *Monodontomerus obsoletus*, F., *M. dentipes*, Boh., *M. virens*, Thoms., *Dibrachys cavus*, Wlk., *Mormoniella vitripennis*, Wlk., *Habrocytus eucerus*, Ratz., *Dirhicnus magnicornis*, Thoms., *Eupelmus urozonus*, Dalm., *Eupelmella vesicularis*, Retz., *Eurytoma appendigaster*, Swed., *Pteromalus puparum*, L., *Pleurotropis* sp. and *Stenomalus* sp.

EWER (R. F.). **Diurnal Activity of three Insect Pests of stored Products.**—*Nature* **152** no. 3848 pp. 133–134, 1 fig., 1 ref. London, 1943.

The observations described were carried out on bags of infested spaghetti stacked in a flour mill and exposed to dim light during the day. Counts were made every hour for 24 hours of the numbers of larvae of *Ephestia kuehniella*, Zell., and adults of *Ptinus tectus*, Boield., and *Calandra granaria*, L., that were active on the surface of a certain area of the bags, for which purpose an electric torch was used for as short a time as possible. The temperature varied from 11·5 to 12·5°C. [52·7–54·5°F.] and the relative humidity was 70–80 per cent. The results showed that *Ptinus* [*cf. R.A.E.*, A **29** 527] and *Calandra* are active at night and inactive during the day, and that *Ephestia* is much more active during the day than at night. During the respective periods of inactivity, the adults of *Ptinus* and *Calandra* hid in cracks and under the bags, whereas many of the *Ephestia* larvae were exposed motionless on the surface of the bags; the greatest number of larvae, both active and inactive, occurred on the bags shortly after dusk.

Casual observations in various parts of the mill showed that the larvae of *Tenebrio molitor*, L., and *P. tectus*, the adults of *Oryzaephilus surinamensis*, L., and *E. kuehniella*, and the adults and nymphs of *Lyctocoris campestris*, F., are all more exposed during the night, which confirmed the general opinion that insects in stored products are more visible by night than by day.

CALLAN (E. McC.). **Sex Ratio affected by Host Plant.**—*Nature* **152** no. 3849 pp. 162–163, 2 refs. London, 1943.

Observations in Trinidad on *Selenothrips rubrocinctus*, Giard, which is an important pest of cacao in the West Indies, West Africa and Brazil, showed that larger populations can usually be found on cashew (*Anacardium occidentale*) than on cacao. This thrips is parthenogenetic, but males occur rarely in the

field. They are active and pair readily with the females, but mating produced no apparent difference in the offspring. Counts made in 1941 and 1942 showed that the males are more numerous on cashew than on cacao, the sex ratios being 1 : 43 and 1 : 695, respectively. Possible causes of this variation are suggested.

CROMBIE (A. C.). **The Development of the Angoumois Grain Moth** (*Sitotroga cerealella* **Oliv.**).—*Nature* **152** no. 3852 p. 246, 9 refs. London, 1943.

In connection with a quantitative study of populations of *Sitotroga cerealella*, Ol., laboratory observations were carried out on the development of this moth at 30°C. [86°F.] and 70 per cent. relative humidity. One hundred freshly deposited eggs were placed singly into small vials, and as soon as they hatched one gram of fine wheat flour was added. Of the larvae, 20 were subsequently killed to make body measurements and 58 died. The durations of the various stages, including the four larval instars, and the body measurements of the larvae, are shown in a table. Development from oviposition to adult emergence was completed in 30–40 days, with an average of 32, and the egg and pupal stages lasted 2–7 and 4–7 days, respectively, with averages of 3 and 5. Full-fed larvae occurred in cocoons in hollows in the flour and became inactive for about 2 days before pupating. One individual, regarded as abnormal, did not give rise to an adult until 72 days after the egg had been laid; all its larval instars were longer than the average, but the pupal stage was normal. The moths usually paired almost immediately upon emergence, and eggs were laid about a day later.

PAPERS NOTICED BY TITLE ONLY.

VAN EMDEN (F. I.). **Larvae of British Beetles. IV. Various small Families** [including keys to Lyctids and Bostrychids].—*Ent. mon. Mag.* **79** pp. 209–223, 259–270, 36 figs. London, 1943. [*Cf. R.A.E.*, A **31** 136.]

BÖVING (A. G.). **A Classification of Larvae and Adults of the Genus** *Phyllophaga* [*Lachnosterna*] (**Coleoptera : Scarabaeidae**).—*Mem. ent. Soc. Wash.* no. 2 [8]+72 pp., 11 pls., 6 figs., 53 refs. Washington, D.C., 1942. [Recd. 1944.]

STANLEY (J.). **A mathematical Theory of the Growth of Populations of the Flour Beetle** *Tribolium confusum* **Duv. VI. Egg Populations in which the initial Number of Eggs is above the limiting Value.**—*Ecology* **24** no. 3 pp. 323–328, 1 graph, 3 refs. Lancaster, Pa., 1943. [*Cf. R.A.E.*, A **30** 368.]

KRATOCHVÍL (J.) & FARSKÝ (O.). **Třásněnka modřínová** (*Taeniothrips laricivorus* **n. sp.**) **původcem odumírani modřínových prýtů.** [The Larch Thrips, *Taeniothrips laricivorus*, sp. n., as the cause of the Dying of Larch Shoots in Czechoslovakia.]—*Lesnická Práce* **20** pp. 233–272, 18 figs. Pilsen, 1941. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 pp. 248–249. Stuttgart, 1943.) [*Cf. R.A.E.*, A **31** 28.]

VOELKEL (H.). **Die wichtigsten Krankheiten und Schädigungen an Kulturpflanzen im Jahre 1941.** [The chief Diseases and Injuries to cultivated Plants (in Germany) in 1941 (including many records of insect pests).]—*Beil. NachrBl. dtsch. PflSchDienst* **21** no. 2. 1942. (Abstr. in *Z. PflKrankh.* **53** pt. 4–7 pp. 264–265. Stuttgart, 1943.)

THOMPSON (B. G.). **Cutworm Control in Oregon.**—*Circ. Ore. agric. Exp. Sta.* no. 147, 4 pp., 2 figs. Corvallis, Ore., 1943. [*Cf. R.A.E.*, A **24** 141.]

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